"Tich Too"—A Model Speedboat

THE MODEL ENGINEER

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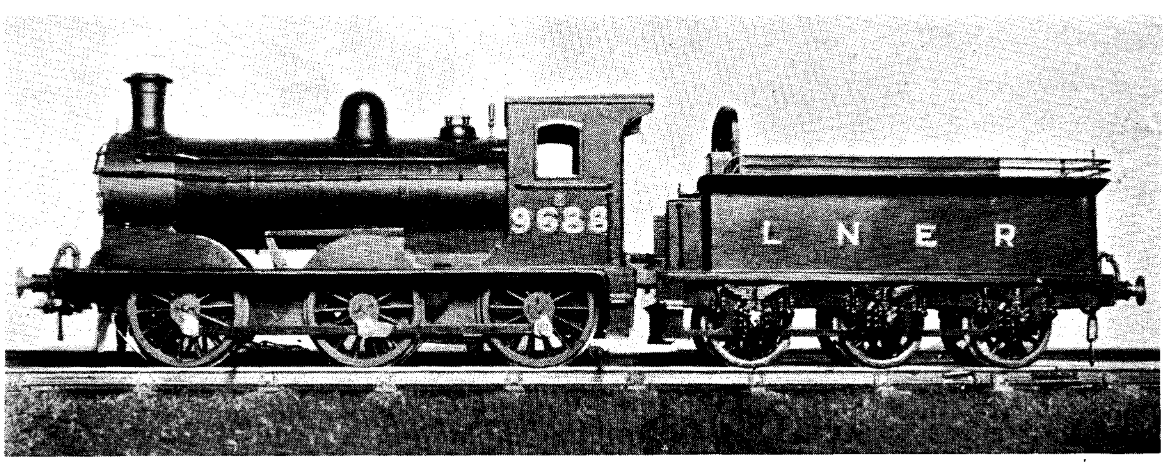
A LADY'S WORK

The reproduced photograph shows a 7-mm. scale model locomotive built by Mrs. P. R. Boswell, of Bickley, Kent. The prototype belongs to a well-known class of 0-6-0 goods engines on the North British section of the L.N.E.R. The model was built from particulars obtained by measuring up and photographing one of the actual engines, during a holiday in Scotland; it is fitted with an electric motor that occupies the whole of the space inside the "firebox"; all the external details—some of which were purchased—are as nearly as possible to scale, and are correctly assembled and positioned. We think that the model reveals a keen sense of detail on the part of its builder, especially as some of the individual operations involved in the construction of the model called for some considerable skill. For example, the tender-sides, back end and front panels, together with the coping all round the top edge, are made in one piece, which presented a problem that required a good deal of thought and careful planning in its initial stages, in order to avoid possible errors being discovered during assembly. Mrs. Boswell owns a complete model railway, built mostly by herself, which will be described and illustrated in the February issue of "The Model Railway News."



THE MODEL ENGINEER

Vol. 82 No. 2019

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January 18th, 1940

Smoke Rings

The Dry-Battery Problem

IT is but natural that, at a time like the present, with the " black-out," difficulties of obtaining hand torches, and other little grievances, we receive many enquiries for information as to how to make dry-batteries and where to obtain the necessary materials used in the process. While we are ready to do all we can to help readers, at any time, there are often many considerations to be taken into account before we can come to a decision as to whether the information we can give is to be of real practical use. This dry-battery question is a case in point; the necessary instructions for the manufacture of dry-batteries, together with a list of materials required, is given in the " M.E." Handbook No. 5, " Electric Batteries," and we could probably add a few notes, amplifying that information, and publish it as an article. What we are not so readily able to do, at present, is to state definitely where the materials are to be obtained; the problem of supply is one that is causing some difficulty to manufacturers, generally, and the amateur constructor is likely to find the difficulty still greater. In these circumstances, we feel that the publication of a detailed article on the subject would fall lamentably short of achieving its main object. On the other hand, if any reader is actually making dry-batteries, in an amateur capacity, at the present time, and would care to submit to us some constructive and illustrated notes dealing with the subject, we shall be pleased to publish them, especially if he can guarantee that the source of supply of his materials is readily available to other readers.

* * *

William Stroudley

DECEMBER 29th last, marked the fiftieth anniversary of the death of William Stroudley, former chief of the Locomotive, Carriage and Wagon Department of the London, Brighton and South Coast Railway. It seems hardly possible that fifty years have elapsed since the great Exhibition held in Paris in 1889, when one of Mr. Stroudley's famous " Gladstone " class of 0-4-2 express passenger locomotives, the *Edward Blount,* was awarded a gold medal for general excellence. This engine was a representative of the best ideas of her designer—his *chef d'oeuvre,* so to speak—and she was being tried out on the P.L.M. Railway of France when Mr. Stroudley contracted the chill and bronchitis that proved fatal, on the night of December 29th, 1889. The *Edward Blount* was brand new at the time, and suffered the great misfortune to burst a tube during the trial; and there can be little doubt that worry caused by this mishap aggravated Mr. Stroudley's illness. Nevertheless, the engine had scored a triumph in gaining her award, and fully deserved the honour. She was typical of the excellence of design and workmanship that Mr. Stroudley, hampered by grave financial difficulties, had managed to standardise at Brighton during his term of office. Mr. Stroudley was a stern disciplinarian, a hard taskmaster, yet scrupulously fair to all who worked under him; nothing but the best satisfied him, and he expressed himself in no uncertain terms when anything displeased him. Yet, there are, even to-day, many who remember " Big-hearted Bill " with affection and respect. His locomotives were extremely popular among all who knew them; they were beautifully constructed, always well on top of their work, and were kept in spick-and-span condition; for their designer, they earned fame far and wide, and they can be regarded as the products of a man who knew what was wanted and did not rest till he got it. Some of his engines, now nearly seventy years old, are still in service, which is a clear attestation of the work that is in them. William Stroudley earned a niche for himself in the annals of locomotive engineering; and his name will be honoured till the end of locomotive history.

* * *

Cage Birds

THE following appeared recently in several newspapers:—" A convict at Southern Michigan Gaol is beguiling his captivity by building a fleet of model aeroplanes. So far, he has constructed nine. They are all petrol-driven. He hopes to go in for model 'plane races when they let him out." There is an old adage to the effect that you cannot keep a good man down; and the above news item would appear to refer to such a man, no matter what his misdemeanours may have been!

Percival Marshall

The History of "Tich Too"

An account, based upon records in the log book of the development of a miniature flash-steam hydroplane

By H. J. Turpin

THIS history of the chequered career of *Tich Too* is offered as a sequel to that of the original *Tich*, which was published in the issues of the MODEL ENGINEER dated Feb. 10th and 24th, 1937, and is, as in the former case, compiled from entries made in the log book which has always been kept of the boat's activities (and inactivities). In fact, it is the only thing that has been kept, for *Tich Too* is no more. She is stripped down to the last screw, and her carcase is hanging from the roof of my workshop like some decrepit old malefactor.

Although the story may appear as a succession of small failures rather than a record of spectacular successes, the reader must be careful in interpreting the word failure. Because certain devices or units have not been successful in *Tich Too*, it does not follow that in themselves they are always inherently wrong. I have not hesitated to make any change in the hope of improving the boat and, in consequence, may have diagnosed a particular trouble wrongly. In fact, that has been the case many times because, as will be read later, the main stumbling block to consistent running was the water pump, whose faults were not fully understood or correctly diagnosed until the end of the season.

Only once during the 1938 season—July 3rd—did the boat show what it really could do, and on that occasion it attained 30 m.p.h. for one lap, after accelerating from 25 m.p.h. The hull ran splendidly, with just a tendency to rock from side to side.

That was the only time *Tich Too* showed any signs of showing off. However, that effort was enough to prove the shape of the hull, so I give here, in Fig. 1, its main features. Dimensions are shown. The profile in the side elevation was arrived at after such alterations as moving the C.G. gradually to the rear, taking the step an inch further forward from its original position and changing the inclination of the thrust line. The boat was originally fitted with a direct drive passing through the step, this driving being successful only for speeds below 20 m.p.h.

There were other alterations which were too drastic to effect, the principal one being the height of front edge of scow. At speed this defect is not apparent, but when the boat is just coming to rest the scow settles too low in the water and more

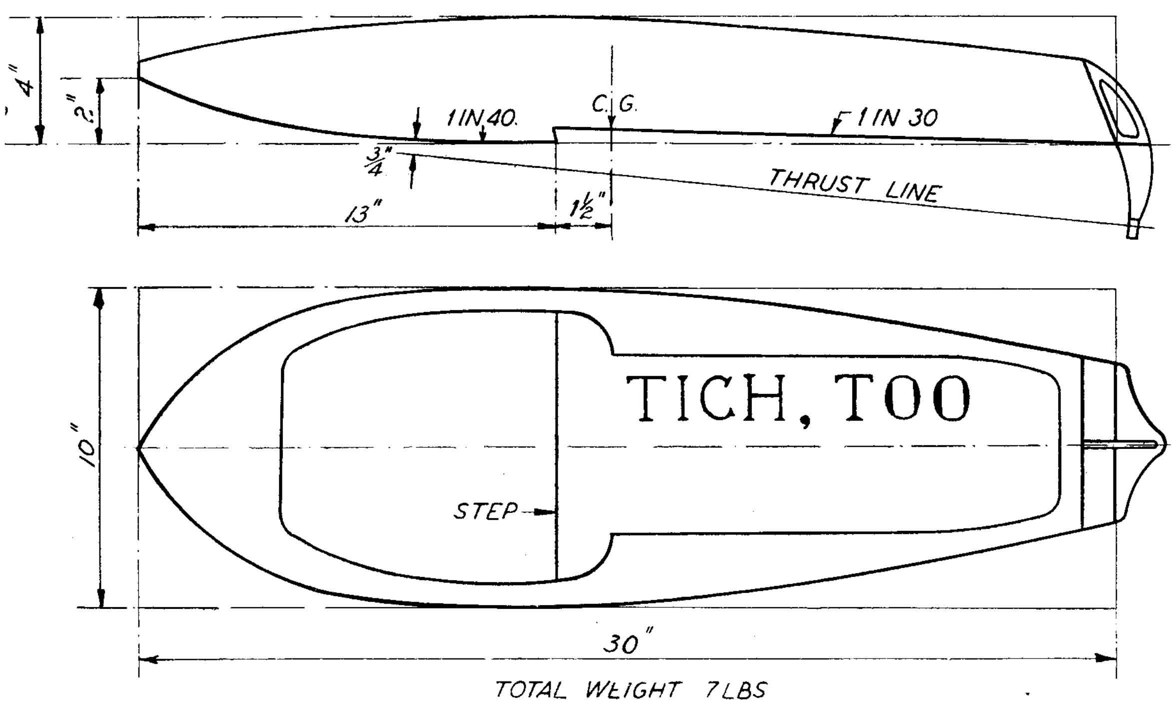
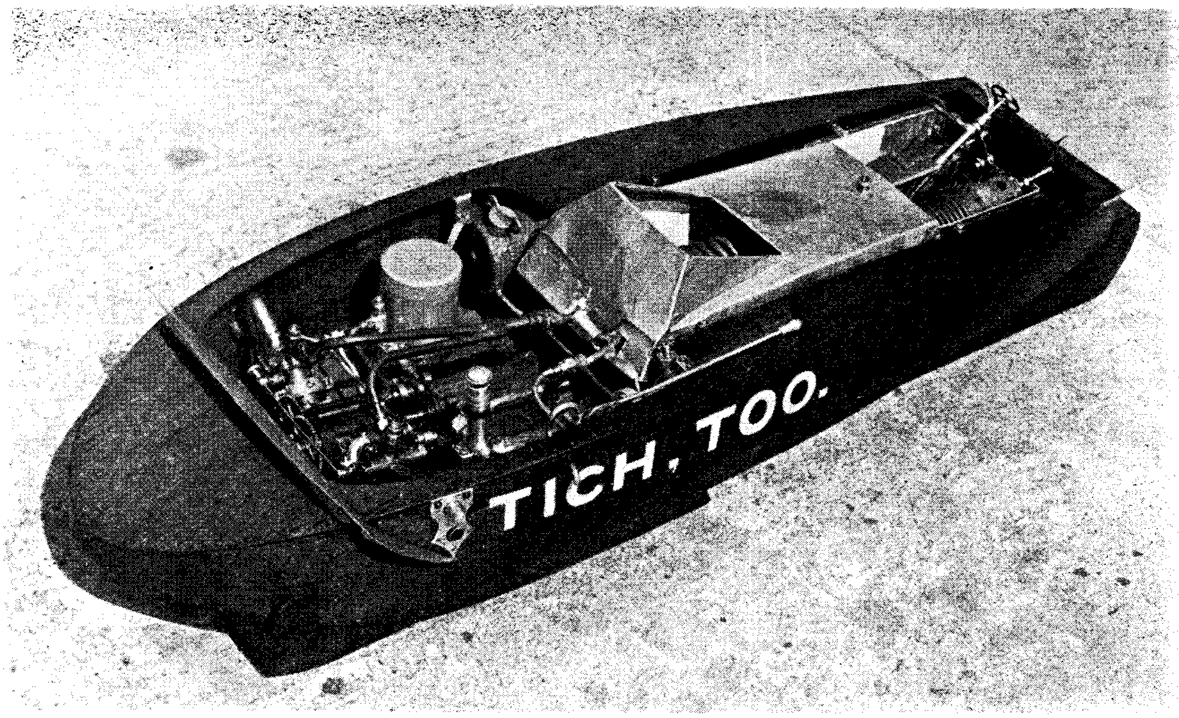


Fig. 1. Outline diagram of hull for "Tich Too."



Three-quarter view, left side, of flash steam hydroplane.

often than not takes a header through an oncoming wave. (They really are waves at Victoria Park !) Many times the boat has been retrieved from the bottom of the pond after such a happening.

Hull

Having given the general shape in Fig. 1, I will enumerate three defects which came to light :—

1. Front edge of scow is a little too low.
2. Sloping stern allows any following ripple, as occurs when suddenly bringing the boat to a standstill, to flop into the hull and extinguish the blowlamp.
3. Width of stern could be increased in order to prevent tendency to rocking at 25 m.p.h. and over.

As can be seen from the photographs, two aluminium cowls had to be fitted in order to prevent flooding. These are shown in Fig. 9. Of course, they are only a palliative and should not be required on *Tich III*, but they are very effective and easily made. It was the shape of the stern after fitting the rear cowl, that suggested the new shape for *Tich III*.

Another hull fitting is the skeg and universal joint shown in Fig. 10. This was introduced because the direct drive—10° to the water line—tended to lift the bow out of the water and, in order to arrive at the most suitable thrust angle, I affixed the propeller bearing to the body of the skeg by two 6 B.A. screws. These ran in two arc-shaped slots whose centre of rotation is at point A in the universal joint. At first it was feared that such two screws would either not be strong enough or would vibrate loose and allow the whole propeller unit to fall to the bottom of the pond, but such a castatrophe has not yet happened. (They say the devil looks after his own.)

The skeg is made from 17 gauge spring steel thinned on front and rear edges. Main propeller bearing is made from $\frac{3}{8}$ dia. silver-steel rod having

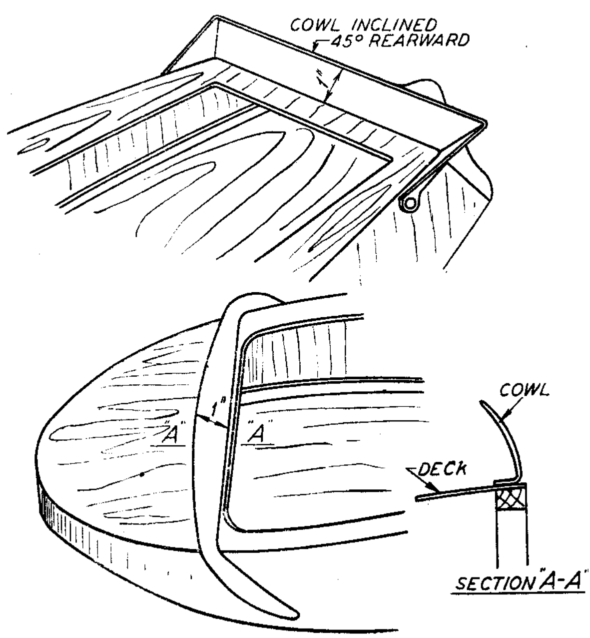
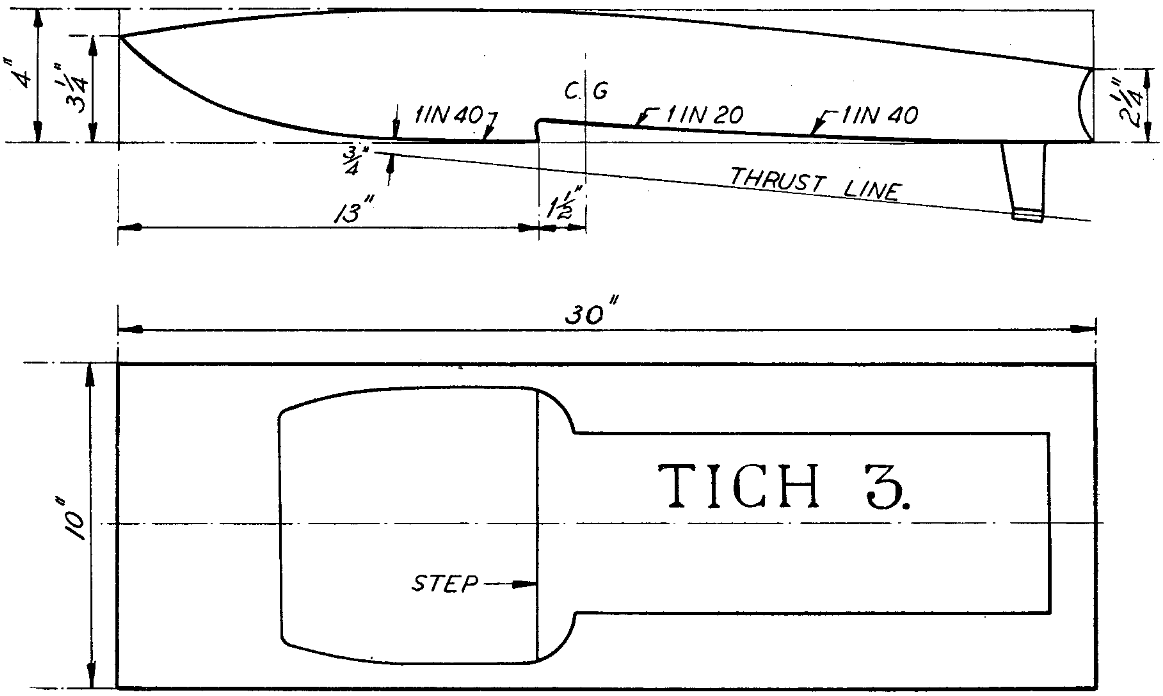
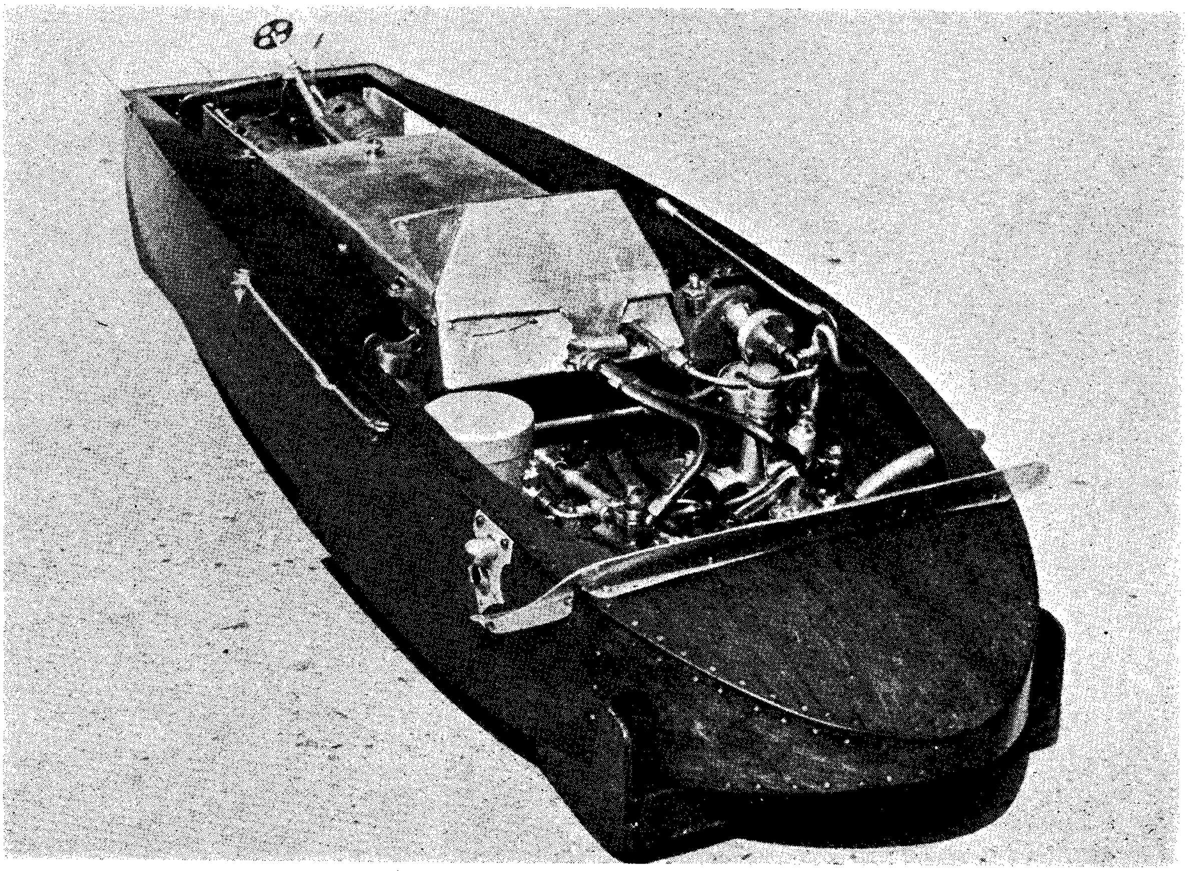


Fig. 9. Front and rear cowls added to hull to prevent flooding.



TOTAL WEIGHT. 6 LBS. 8 OZ.

Fig. 2. Modified shape of hull based on experiences with Fig. 1.



Three-quarter view, right side.

a plain bearing at front end and a track for eleven 1/16 steel balls at rear. To this bearing is brazed the bracket carrying the two fixing slots. The rear end is then hardened and tempered and ball track polished. In this bearing runs a silver-steel shaft having a hexagonal hole formed in the front end

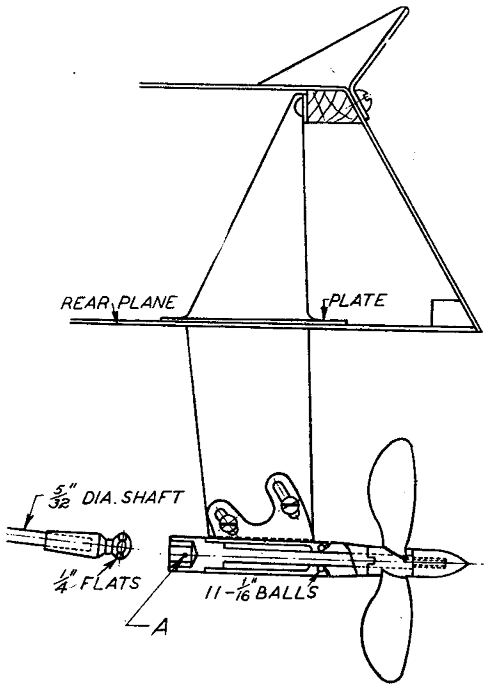


Fig. 10. Skeg and adjustable propeller bearing.

and a hardened steel collar for driving the propeller sweated on the other after assembling the balls.

The hexagonal hole in the end of the shaft was made as follows: a hole, whose diameter equals the distance across the corners of the hexagon, is drilled in the end of the shaft, which is then made red hot and beaten in about half a dozen stages over the end of a hexagonal rod. Turning is effected by driving from a stub of hexagonal bar held in the self-centring chuck.

Propeller is steel 2¾ dia., 6 in. pitch.

Mainshaft is 5/32 dia., and has a sleeve with a hexagon head sweated on to engage the hexagonal hole in the small shaft. The other end, taking the drive from the engine, passes through the step bearing shown in Fig. 11. Construction of this is simple, being made to incorporate a chamber sufficient to carry plenty of thick oil. It is made from ⅜ dia. brass rod drilled out 5/32 dia. at rear end, and a disc with a 3/16 dia. hole sweated in the front. An aperture is then made to admit oil. This bearing is made rigid by being sweated to a steel bracket which in turn is screwed to the step.

Having laid bare the peculiarities of the hull, I have put in a drawing of the one for *Tich III* in order to suggest some positive information. This embodies the remedies that have been mentioned. Main dimensions are the same but height of scow has been increased to 3¼ in., and stern made curved convex fashion in order, first, to produce an efficient trailing edge, and second, to turn back any following water. Rear plane is made slightly flatter, too. In plan this hull is rectangular, which gives maximum width of step and trailing edge

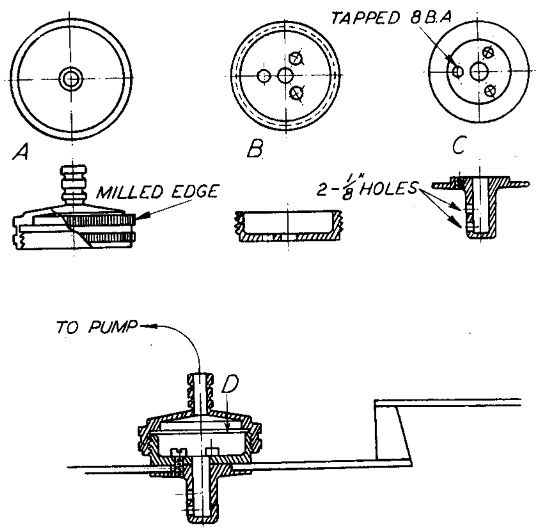


Fig. 3. Duralumin pick-up, straight from the lathe.

which, it is hoped, will produce the little extra stability. Other features, such as C.G., thrust line, skeg position, weight distribution, and total weight, remain approximately the same.

Water Pick-Ups

There are as many ways of making a pick-up as there are in killing a cat. Most of them, of course, end with the same result. Having a greater

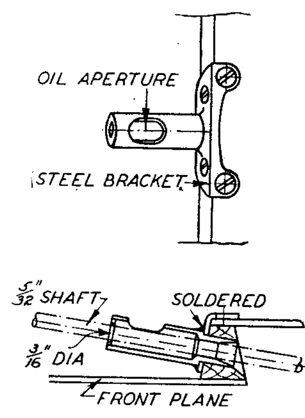


Fig. 11. Front propeller shaft bearing with oil-container.

preference for turning than for fitting I set about making a pick-up and filter combined straight from the lathe, and always keeping in mind that lightness is always a consideration I made it up from duralumin bar, 1¼ in. dia. The design of this is illustrated in Fig. 3.

(To be continued)

A Plea for Fresh Ideas in Model Making

By "Adage"

WHY is it that, generally speaking, model makers are so conservative in the work they produce? Comparatively few attempts are made to break away from traditional types of modelling, and this is to be regretted, as the standard of workmanship is now so high that well-made models of original subjects would be both welcome and useful.

Analysing the competition exhibits at the last "M.E." Exhibition (1938), the following figures speak for themselves:—Engines, 35% (locos. 15.5%, others 19.5%); Ships, 34.5%; Model railway accessories, 7.5%; Aviation, 4.5%; total, 81.5%.

From these it will be seen that only 18.5% were of a miscellaneous type; this is surprising, taking into consideration the large range of subjects as yet practically untouched. Why engines should rule the field is open to debate—it may be that, being prime movers, there is a special fascination in constructing something in which the wheels go round; and, of course, there is also a good source of supply for castings, fittings and other parts.

Surely, however, the latter is a perfectly good reason for *not* making so many models of this type? The serious modeller is not perturbed by the fact that he is unable to purchase parts already in existence (either in rough or finished form); on the contrary, there is a keen sense of accomplishment when he has made all his own patterns, etc., and has fabricated the whole of the work himself. Much can be done by building up from strip and bar, utilising scrap, and generally exercising ingenuity in making what he needs. This naturally takes longer, but as the essence of model making is to provide a hobby, time scarcely enters into the question, and is certainly (except in the case of professionals who have to make their living from it) not to be reckoned against the achievement of building a model which may be unique.

In these days of stress, this argument has all the more force, in that, although owing to various forms of national service the average model engineer's spare time is very much curtailed, the ability and opportunity to concentrate on something fresh has a beneficial effect by providing interest and relaxation from the worries of life.

A few suggestions are given below for "something different," which may commend themselves. Isolated examples of some of these have occasionally made an appearance, but, as a general rule, the majority have not been exhibited except, perhaps, in technical museums. Many would make excellent models; the list is by no means exhaustive, and is intended merely as a starting point for further ideas. For instance, the item "machine tools" covers an immense range; included in this are presses, milling machines, lathes of all descriptions (including automatics), shapers, slotters, power hammers, drilling, boring and broaching machines, etc., and all types of machinery constructed for special purposes or particular branches of industry.

Aerial ropeway.
Agricultural machinery.
Automatic coal grab.
Bascule bridge.
Bicycle.
Blast furnace and conveyor.
Blueprinting machine.
Cargo winch.
Concrete mixer.
Conveyor system.
Dental chair.
Diecasting machine.
Diesel engine (section).
Dry cleaning plant.
Dynamometer.
Escalator.
Farm tractor.
Floating bridge (for ferry services).
Floating crane.
Floating dock.
Greathead tunnelling shield.
Hansom cab.
Horse omnibus.
Hydraulic capstan.
Hydraulic ramp (garage).
Laundry machinery.
Lift (working).
Machine shop.
Machine tools.
Marine salvage equipment.
Microscope and accessories.
Military tank.
Motor cycle.
Motor (or trolley) omnibus.
Ore unloader.
Outboard motor.
Petrol pump.
Pithead gear.
Pneumatic road-drill.
Printing machinery.
Refrigerating plant.
Rock drill.
Roundabout (showman's).
Saloon car.
Searchlight.
Scherzer rolling-lift bridge.
Spectroscope.
Steam shovel.
Strongroom door.
Submarine.
Swing bridge.
Tar boiler.
Testing machine (for metals).
Textile machinery.
Titan crane.
Trailer pump.
Transporter bridge.
Travelling crane.
Water tower (fire brigade).
Well-boring machinery.

Consider the large field covered by printing, textile and agricultural machinery and equipment alone. What a fine model a modern printing press would make! Even the dental chair mentioned above, although it may give rise to a few smiles (and possibly some recollections!), calls for some ingenuity and good workmanship to complete it satisfactorily.

(*Continued on page* 59)

*Simple Photographic Enlargers

An all-metal miniature vertical enlarger

By "Kinemette"

ANY good photographic lens of suitable focal length can be used as an objective, and provision is made for mounting various types of lenses in the focussing jacket ; but experiments have been made with simpler forms of lenses, and excellent results have been obtained with a cheap form of achromatic doublet, which will, it is hoped, be available to readers in due course. It should be noted that the use of very short-focus lenses, more especially if they are of not very large aperture, is extremely difficult when using ordinary domestic lamps in condenser enlargers, owing to the difficulty of focussing the light into a very small spot so as to pass through the objective.

Construction

Some of the instructions given may have to be modified according to the materials available, as parts built up from sheet or tubing will obviously require different treatment to those made from castings. The use of castings is strongly recommended if they can be obtained, as it is really far easier to make an accurate and workmanlike job by machining than by bending and joining, and the rigidity of the job when finished is usually much better. If aluminium castings can be obtained, it will also be a good deal lighter. The alternative method of construction may, however, be preferred by those who are handier with coppersmith's tools than with the lathe. It is quite likely that the scrap-box may yield parts sufficiently closely resembling some of the components for them to be pressed into service, and there is no objection whatever to this course so long as the essentials of the design are adhered to.

Upper Casing (Fig. 3)

The machining of this part presents few problems if a casting is used, as it can be set up in the chuck, over the outer steps of the jaws, with the top side outwards, for boring the centre hole and facing the top of the recess. It is then reversed, and gripped inside the recess for machining the lower edge, the registering recess for the lamphouse body, and the lower face of the centre hole. No further machining, either inside or outside is really essential, but may be considered desirable to lighten the casting or improve its appearance. Finally, the ventilating holes are spaced out and drilled.

If a pressing or spinning is used, little or no machining will be necessary. The registering recess should in this case be formed by a rebated lip, but if this is not provided, the proper location of the casing, when assembled, may be attained by soldering a ring of heavy wire around the cylindrical lamphouse at the required distance from the edge ; this applies to both ends of the latter, when no means of end location of the casings is provided.

Lower Casing (Fig. 4)

This casting can be held in the chuck by the sleeve which fits over the condenser housing, and all machining done at one setting, with the exception of facing the lower edge. The sleeve should be bored smooth and parallel, and the spigot at its upper edge trued up to the dimensions given, to fit the light trap.

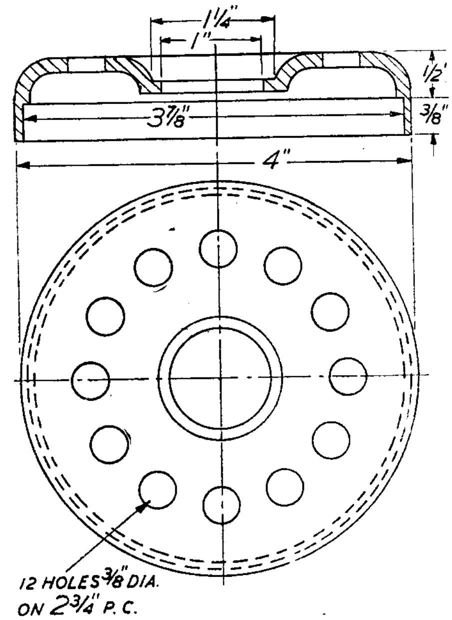


Fig. 3. Upper casing.

If a pressing is used, the sleeve portion will have to be attached to it. It may be mentioned, for the benefit of those who are not already aware of the fact, that brass tubing is obtainable in a wide range of sizes which will "telescope" one into the other, and for building up this and other parts of the enlarger, the appropriate sizes of tubing should be obtained. Actual dimensions do not matter, so long as the condenser lenses, or other ready-made parts which have to fit the tubes, can be properly accommodated. It may be found necessary to skim the tubes out very slightly, or

* *Continued from page* 37, "*M.E.*," *January* 11, 1940.

reduce them a little on the outside to make them a push fit ; this can be done by using hand tools in the lathe, so long as care is taken to support the tubes by wood bungs or mandrels so that they are not distorted in the chuck. The end faces should also, of course, be trued up.

In the component under discussion, it is best to use a fairly thick tube, so that the sleeve portion may be turned down slightly to a shoulder, against which the pressed or spun flange (which is bored to just push over this portion) is registered, and secured by sweating.

Light Traps

These may be made from thin copper or aluminium by spinning or hammering over the

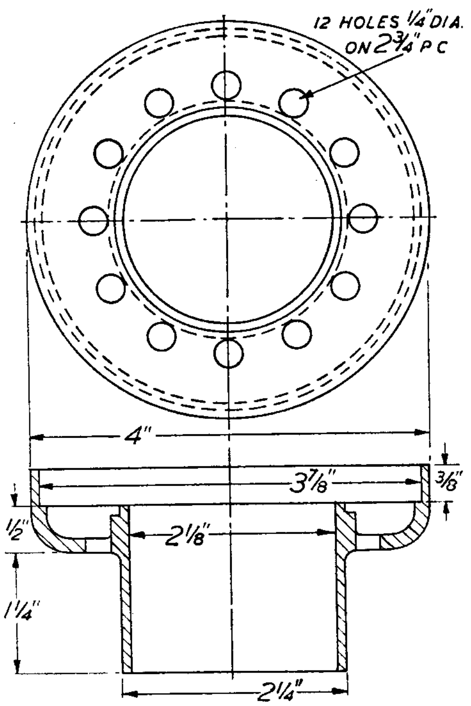


Fig. 4. Lower casing.

edges of a metal disc of appropriate diameter. It is, however, quite likely that tin lids of suitable size may be obtainable, and in that case, it is only necessary to "trepan" the centre hole out by fitting the lid over a wooden disc turned to the required size, and applying a pointed tool to it as it is rotating in the lathe.

The upper light trap is clamped in position by the shade ring of the lampholder, but the lower one is just pushed over the spigot projecting inside the lower casing, no fixing being necessary, if it is a reasonably good fit. It is most important that the light traps should be dead-blacked all over, inside and out, to avoid reflection of light, and the same treatment should be applied to the inside of the casings, and the cylindrical part of the lamphouse.

Condenser Housing (Fig. 5)

There is little to choose between a casting and a built-up component in this case, and in either, the work is quite straightforward. The casting should first be chucked over the edges of the

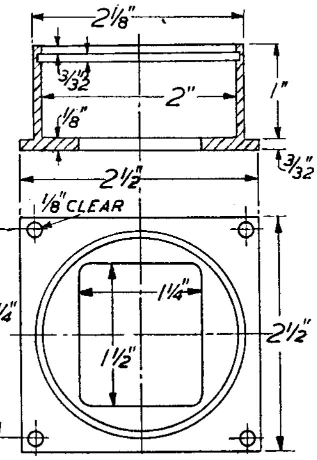


Fig. 5. Condenser housing.

square flange in the four-jaw chuck, and machined both inside and out, then reversed and held over the jaws of the self-centring chuck to face the underside of the flange.

If the component is to be built up, a suitable piece of tube should be selected, faced off to length, and grooved internally to take the spring retaining ring. A piece of $\frac{1}{8}''$ brass plate is cut roughly to size for the square flange, and is then

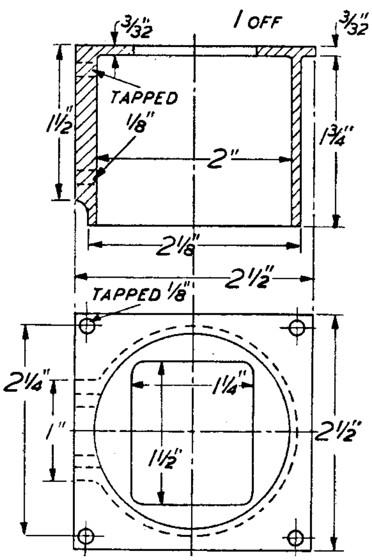


Fig. 6. Stage housing.

held in the four-jaw chuck and faced back 1/32", leaving a spigot a snap fit to the inside of the tube, which is then sweated to the plate.

The masking aperture is filed to shape in either case, and the square edges trued up, after which the four screw holes are drilled in the corners of the flange.

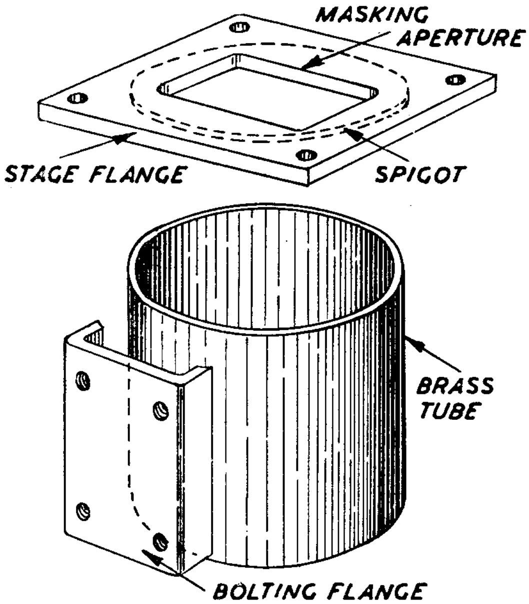


Fig. 7. Method of building up the stage housing from tube and sheet brass. A similar method may be employed for the condenser housing.

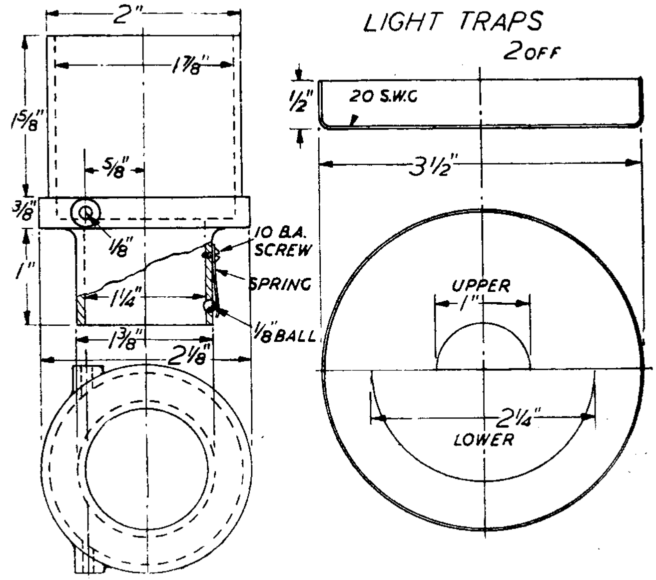


Fig. 8. Details of draw tube and light traps.

Stage Housing (Fig. 6)

The procedure for machining this part is much the same as that previously described, except that it is neither possible or necessary to machine all over the outside, owing to the existence of the saddle plate to which the cantilever is attached. If the part is built up, this plate must of course be sweated on; either a thick piece of brass plate, scooped out to fit the side of the tube, or a thinner plate, bent down sharply at the two sides, may be used, but the latter does not provide so much solid metal for tapping the screw holes, and great care will be called for in this operation, as it is not practicable to allow the screws to project inside the tube. (See Fig. 7).

(To be continued)

A Plea for Fresh Ideas in Model Making

(Continued from page 56)

A working model lift would provide many interesting hours' occupation. It should not be difficult to arrange for the cage to stop automatically at any " floor " desired, with gate switches, safety device, etc., and to be actuated by a set of push-buttons (possibly interlocked) in the base.

Who has seen a model of a kerbside petrol pump? Yet this would be a novel thing to make, presenting some awkward problems, and would indicate some originality.

For those who are not sufficiently skilled to tackle any of the above, simpler jobs are available. The tar boiler would make a good exercise—this is practically all sheet metal work, riveting, and so on, and is not to be despised because it is such a humble member of road making equipment. Again, a model of a dry cleaning machine (the type which can be seen in the shop windows of dyeing and cleaning firms) would be effective—and new!

There are, of course, no drawings available for many of the above suggestions, but this should not prevent the serious modeller tackling them. So much can be done from catalogue illustrations, photographs, technical articles, or by actual measurements taken direct from the original. Witness the fine model of a 12" howitzer mounted on a railway truck, made by Mr. Mendez, and exhibited in the 1932 " M.E." Exhibition (a description appears in the " M.E." of February 9th, 1933). This was built from a single drawing on which only one dimension was given, and is a splendid example of (a) an attempt to break away from traditional types; (b) ingenuity in utilising scrap material and special methods; (c) obtaining details of a difficult subject about which practically no information is (or was) published; and (d) good workmanship. Read the article if you can!

Another very clever model was one constructed by Mr. Fenn, also exhibited in the 1932 " M.E." Exhibition. This represented the interior of a small workshop, with two model makers busily engaged on their craft, and was a highly original idea, well carried out. (A photograph appears in the " M.E." dated September 29th, 1932). Many more ideas will suggest themselves to readers, and as half the enjoyment of the hobby is found in constructing unconventional models, why not make " something different " for *your* next attempt?

Out of their Element!

By "L.B.S.C."

AT the time of writing, the submarine section of the British Navy is very much in the news; incidentally, the skipper of the *Ursula* who made a nice mess of one of Mr. Hitler's large power boats—absolutely did it on purpose, too, the naughty boy!—is the son of an old and valued South-Coast correspondent who builds $3\frac{1}{2}''$ gauge locomotives, and is himself interested in them. Therefore, the reproduced pictures of what some of these sons of Neptune get up to, when not engaged in rubbing out swastika trade-marks, may be of added interest. The pictures need no description; all regular followers of these notes will recognise the railway. The engine, built to my specification for "Purley Grange," plus some fine extra detail work, by Lieut.-Commander J. B. Mitford (he of the dark coat) goes as well as ever, and had no difficulty in taking Commander Shadwell up the big hill. May the day soon be here when our worthy friends will have nothing more perilous to trouble about!

MISS TEN-TO-EIGHT

Tender Beams

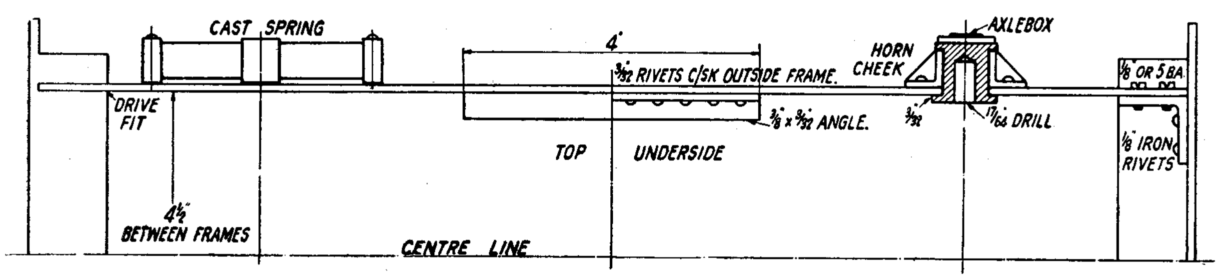
The tender beams are made of exactly the same section angle as those on the engine, but they are slotted at a different spacing, the tender frames being $4\frac{1}{2}''$ apart. The sketches give all the necessary dimensions. Have the slots a tight fit for the frame plates, as with the engine, because it is just as important to have a square and true frame for the tender, although there are no "works" under it. Rivet pieces of angle to the underside of the beams, inside the slots, as shown, hammering the rivets into countersunk holes on the outside of the beams, and filing off flush.

Before erecting frames, the horn cheeks and springs may be fitted, as it makes for easier work. Some of our advertisers sell cast horncheeks for $3\frac{1}{2}''$ gauge engines, any of which will be suitable, as they are all "much of a muchness." Unlike the $2\frac{1}{2}''$ gauge castings, which are in one piece with a dummy spring, most of the $3\frac{1}{2}''$ gauge castings are separate; and either proper leaf springs, or cast dummies with a spiral spring in the buckle or hoop, may be used. Cast horncheeks only need cleaning up on the rubbing faces with a file; rubbing them on a big flat file laid on the bench, is the quickest way of getting accurate faces. Rivet them at each side of the slots in the frame, not level with the bottom, but 3/16" above it, so as to leave room for the hornstay. If you do not wish to use castings, or cannot readily obtain them, pieces of $\frac{1}{2}''$ by 3/32" angle brass will do very well. The plan sketch of the tender frame assembly, shows a pair of horncheeks in place, with the axlebox between them.

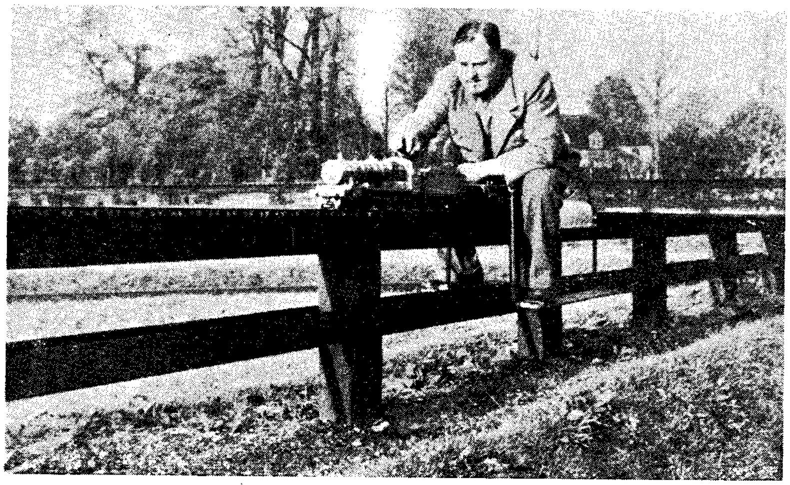
If cast dummy springs are used, simply drill a $\frac{1}{4}''$ blind hole in the underside of each buckle, and attach the spring to the frames, above the horns, with the buckle centrally over the opening, by means of rivets or screws through the cast-on hanger bosses. Real working leaf springs can, however, be used, and are very little extra trouble to make. The hoops or buckles are pieces of $\frac{1}{2}''$ square rod drilled up and parted off in four-jaw, the holes afterwards being filed out rectangular. Alternatively, they can be made from channel section, either bought in that form, or made by milling a groove in a piece of square rod, which is the method I usually adopt. The channel is placed, open side down, on a length of strip metal of same width, and the joint brazed at each side. The resulting square tube is chucked in the four jaw, and lengths parted off as required.

Springs

The trouble with many small leaf springs made in the past, is that if they flex properly, they do not look "fat" enough; and if the necessary degree of obesity is given them, they are too stiff to flex. Mr. Tom Glazebrook solved this problem in an ingenious manner, by using "laminated plates." On his American locomotive now under construction, the springs are apparently made with the "scale" number of plates, of "scale"

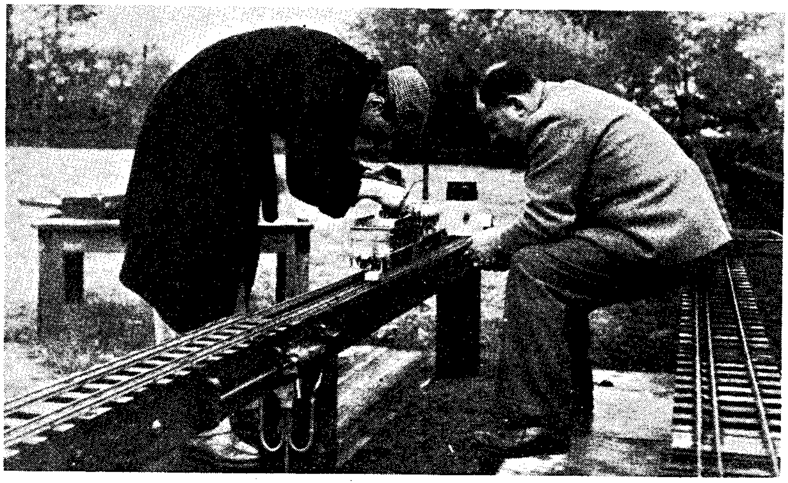


Half plan of frame assembly.



Commander Shadwell, though not surfacing, is "going up."

thickness, yet they flex perfectly. When you look closely, you see that each plate is not solid, but is itself composed of several thin plates of the same length, giving the appearance of one thick plate. I used this dodge on the trailing truck of my "hush-hush" "Pacific", shown in the reproduced photo, the springs of which look as though they have eight plates, but in reality have twenty-four. Similar springs for the tender we are describing, can be made from commercial spring steel $\frac{3}{8}''$ wide and No. 30 gauge. The outside dimensions of the hoop should be $\frac{1}{2}''$ high, $\frac{1}{2}''$ front to back, and $\frac{3}{8}''$ wide on face. The plates are clamped in the hoop by a $\frac{1}{8}''$ grub screw tapped through the bottom, the end of the grub screw resting on the axlebox when the spring is erected. You cannot see this grub screw in the picture, because it is hiding away in the dark cavity between the bottom of the hoop and the top of the axlebox.

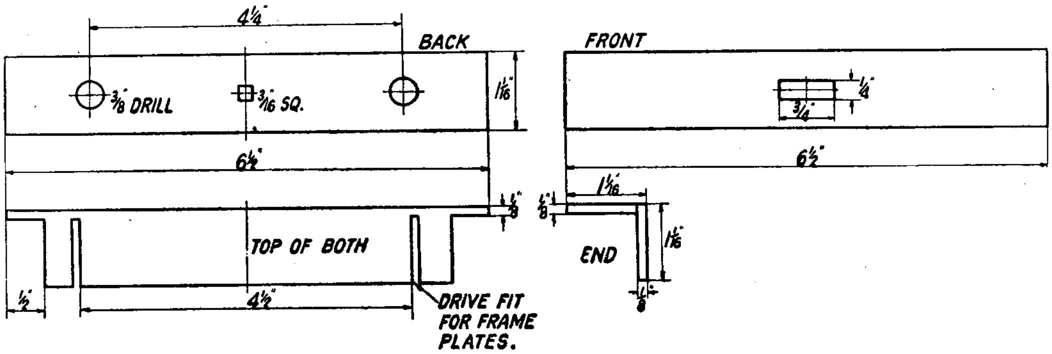


H.M. Submarine service prepares for action.

The hangers are made from $\frac{1}{8}''$ silver-steel rod, screwed at both ends. The upper end passes through a 9/64" punched hole in the top springplate assembly; I have described several times in full, how to make a punch that will cut a clean hole in hard steel; but for new readers' benefit, chuck about 2" of $\frac{1}{4}''$ round silver-steel in the three-jaw, and turn down $\frac{3}{8}''$ of it to 9/64" diameter, tapering it slightly from the extreme end, which should be carefully faced off to ensure an absolutely flat surface. This is most important; if the end is not flat, the spring steel will split when you try to punch it. It will also split if you do not taper the punch away from the cutting edge. Harden and temper to dark straw. Place the spring leaf on a smooth block of lead, hold the punch exactly vertical. over the spot where the hole is to be, and give it one mighty crack with a hammer. The punch will probably sink "up to the hilt" in the lead, but that does not matter a bean, you will get a clean hole in the steel.

The photo also shows the suspension complete. The lugs into which the hangers are

A craft leaves port !



Tender beams.

screwed, are turned up from $\frac{3}{8}''$ by $\frac{1}{8}''$ flat steel held in the four-jaw. A $\frac{1}{8}''$ pip $\frac{1}{4}''$ long is turned on the end, screwed $\frac{1}{8}''$ or 5 B.A., and the piece parted off. The end is rounded with a file, drilled and tapped for hanger, poked through a No. 30 hole in frame, and secured with a nut. A lock nut is placed on the hanger underneath the lug, to prevent the hanger getting out of adjustment when the engine is travelling at high speed over a rough road. The adjustment is made when the tender is finished, with the tank three parts full of water, and a load of coal on board. It is a simple matter to adjust the hangers so that the running board of the engine lines up with the soleplate of the tender, as you will see when the time comes to do it.

Axleboxes

Castings sold for "Maisie" and other engines can be used for the axleboxes, or they can be milled or planed from $\frac{7}{8}''$ square brass bar. The boxes shown in the photo were milled out of the solid. Readers who have no milling machines can press their long-suffering lathes into service once more; clamp the castings, or pieces of rod, on their sides under the lathe tool holder, or in a machine vice attached to the invaluable vertical slide (I hope Santa Claus did not forget a case of vertical slides when loading up his Reindeer Twelve!) adjust or pack up to lathe centre height, and traverse across a $\frac{5}{8}''$ end-mill, or a home made slot drill, held in the three-jaw. Another tip for new readers: speculate a few coppers on that useful MODEL ENGINEER handbook, "Milling in Small Lathes." The merchant who wrote it, knew what he was talking about; and it will help you quite a lot, in many branches of our locomotive-building craft. Backs and faces of the axleboxes only need cleaning up with a file, and drilling for axles as sketch. The hornstays are strips of 3/16" by 3/32" steel held in place by 3/32" or 7 B.A. screws.

The frames are assembled same as locomotive frames; drive them into the slots in beams, test for truth on lathe bed or something equally flat, and fix them permanently by $\frac{1}{8}''$ or 5 B.A. screws run through clearing holes in the frame, into tapped holes in the angle. Four in each will be found quite sufficient.

"Lobby Chat"

About 95 per cent. of my Christmas letters asked for a renewal of one of the most popular features of the old "Live Steam" notes, so we shall have to see what can be done about it. In full-size practice, the enginemen's lobby is an unofficial bureau of information, all of which is based on actual personal experience. It is a wonder to me, that the C.M.E. and his staff, do not make more use of it; true, they might not always feel exactly flattered by the "current news and comment," but the constructive criticism would, in my humble opinion, be well on the credit side. Consider, for instance, the occasion of a big race meeting in a provincial town, with the "shadow of the swastika" obliterated for ever, and many special trains bringing huge crowds of happy folk, for a day's enjoyment, from various parts of the country. The local depot is soon filled with "foreign" engines; their crews adjourn to the "mess-room" (official title!) with tea-bottles and tommy-baskets or bags, and as soon as the "inner man" is satisfied, they begin to "talk shop," as is only natural. Everybody present being an experienced and practical person, the conversation, though it might not exactly be suited to a Mayfair drawing-room or a Band of Hope meeting, often contains criticisms, comparisons, and suggestions which might prove of great value if put into practice. Some of these impromptu debates and arguments present a "certain liveliness" which is certainly not found at the Mutual Improvement classes!

Climbing Grades

Turning to our own subjects, Mr. Burgoyne wants to know if I can explain why his 0-8-0 with small cylinders, will take as much load up a 1 in 50 grade as his "Bullock Pacifics" with bigger cylinders. In my humble opinion, it is—apart from the valve gear question, upon which I am unable to pass comment without seeing and testing the

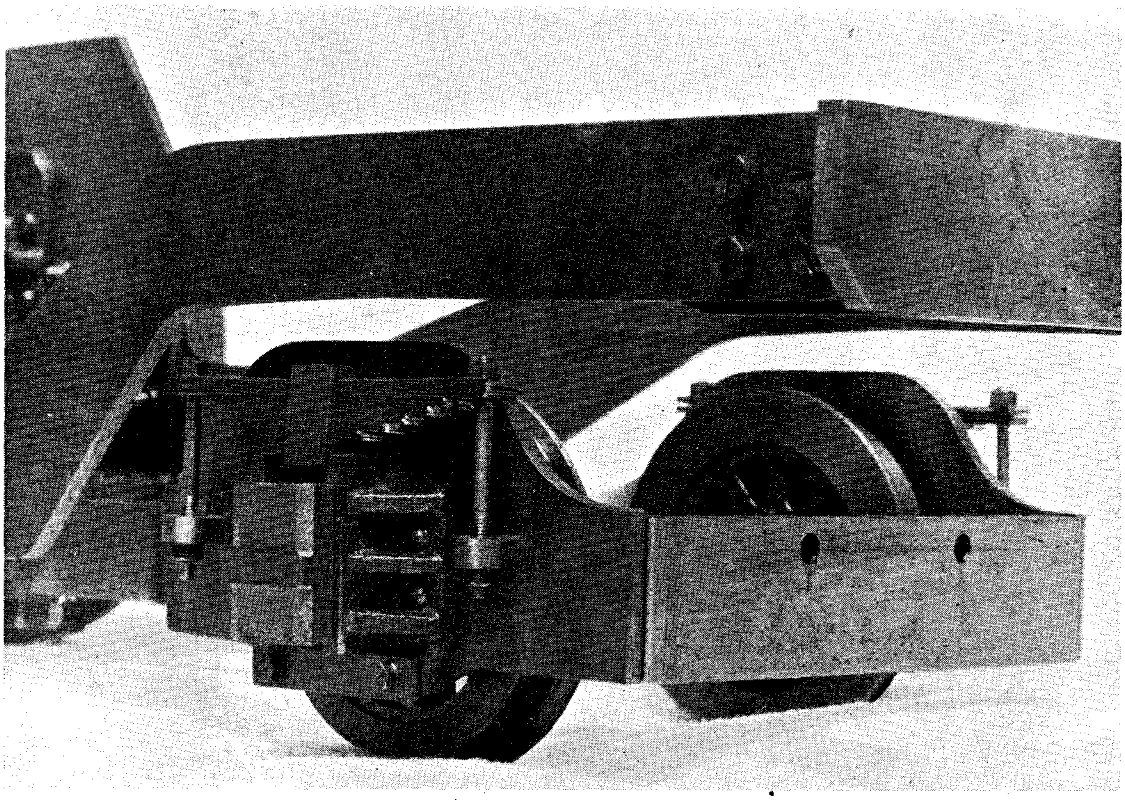


Photo by [*C. J. Grose.*

Note working multiple-plate spring. (Tension released to show laminations.)

locomotives for myself—that an 0-8-0 is more suited to haul a big load up a stiff grade, than a 4-6-2. On the level, the "Pacific" would probably reach a speed with the same load, which would put the 0-8-0 in the category of an "also-ran."

A Prototype Parallel Case

Here is a parallel case in big practice. At one of the L.B. & S.C.R. running sheds, the "pilot" or shed engine was a little "Terrier" with 4 ft. wheels, 13" by 20" cylinders, and weighed 24 tons. This midget would haul out a whole row of "dead" engines, and would need all the regulator and lever to do it. When she was l id off for any repairs, washing-out, etc., an "E" class goods tank with 17" by 24" cylinders, 4' 6" wheels, and a weight of 40 tons, temporarily took her place. This engine would not start a bigger load than the "Terrier," though the calculated tractive effort was greater; and if you gave her the lot, she would slip on dry rails. BUT—and this is "the rub"—once she was on the move, you could give her more steam without causing her to slip, and she would accelerate; whereas the "Terrier," already having the lot, "had nothing up her sleeve" in a manner of speaking, and merely crawled down the yard with her load, at little more than walking pace.

Now, in the case of Mr. Burgoyne's 0-8-0, she would, after breasting the summit of the bank, begin to accelerate; but already having the lot, the tractive effort would fall as the speed increased, until they kind of "balanced," and she would stick at a given speed, unable to go any faster (just like Bob Billinton's radial tanks). When the "Pacific" topped the rise, and began to accelerate, the tractive effort, instead of falling, could be maintained by giving her more steam. Mr. Burgoyne says they will not take full regulator on the bank; this is as it should be, because if they did, you would have nothing in reserve to maintain their speed and acceleration on the level, when the pistons are what I call "running away from the steam." By the time the "Pacific" had "got the lot," she would have left the 0-8-0 miles behind, and when the tractive effort and speed finally "balanced," would be travelling maybe twice the speed of the 0-8-0. That is where big cylinders score.

The above explanation may not be "scientific," but it is an old engineman's version of what actually happens. Many an old driver has apparently pulled a young fireman's leg by telling him that a single-wheeler is more powerful than a six-coupled goods—and at a speed of ninety miles an hour or so, the statement is absolutely correct!

Model Engineers and National Service

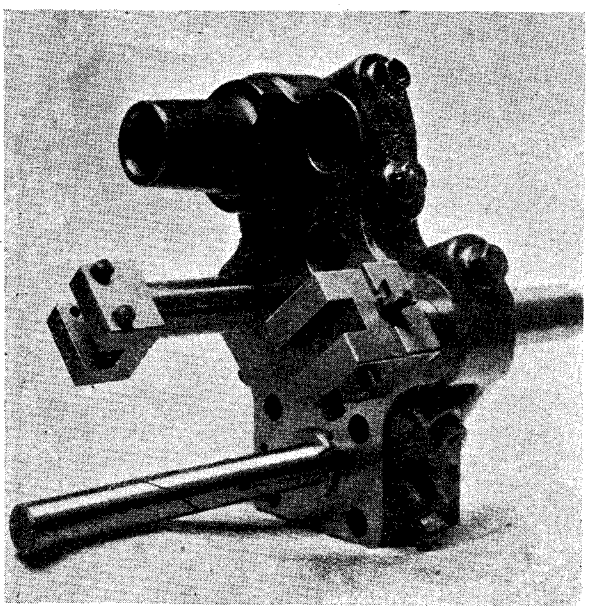
* Capstan and turret lathes

By Edgar T. Westbury

The Overhead Support

THIS fixture is one of the most important steadying devices employed on capstan and turret lathes, and is especially useful in operations entailing the simultaneous use of several cutting tools. It steadies the entire tool head by means of a stout, rigid bar, which extends from the headstock right over the work, and slides in a bush carried in the tool-holder. The bush must fit the bar closely, so that side play is eliminated, and the bar is clamped firmly to the lathe headstock, either in integrally-cast housings over the bearings, or in a special clamp attachment, so as to be exactly parallel with the mandrel axis in both planes.

Essentially, it matters very little whether the bar is carried on the headstock and the bush on the tool-holder, or *vice versa,* and both arrangements are encountered in practice. It is sometimes considered advantageous to use the second arrangement, as the effect of any slight play in the bush is minimised by locating it at a point further from the tool-head centre than the cutting tool. Against this, however, is the disadvantage involved by having a long bar (or, in some cases, two or three) swinging round on the tool-head, taking up abnormal space and possibly impeding the operator; consequently, the first arrangement is the more commonly employed.

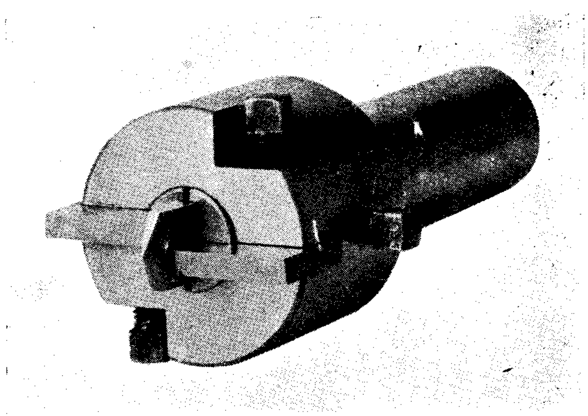


Combination tool holder for boring, turning and facing tools, equipped with bush for steadying by means of an overhead support bar.

Finishing operations on bores which have to be within close limits of parallelism and roundness (such as cylinder bores, for instance) are almost invariably carried out by tools supported in this way, but in such cases it would not be desirable to use other tools simultaneously.

Concentric holes are produced on capstan and turret lathes by generally similar methods to those with which we are all accustomed, but here again there is a good deal of specialisation in the design of the actual tools employed. Centring is first carried out, using a centring fixture such as the combined centre-drill and work-stop previously described, or a centre-drill carried in a plain stub-holder. A flat spear-point drill is often used for starting fairly large-sized drills, and the holder illustrated herewith comprises a short drill of this type, together with two cutters which face the end of the work.

Twist drills are extensively used for holes of small and moderate size, though straight fluted drills are favoured for brass and similar materials. It is usual to employ a short drill, mounted in a stub-holder, so as to support it as rigidly as possible, unless the depth of the hole being drilled makes a long drill absolutely necessary. The use of drill chucks of the ordinary type is not usually considered desirable, owing to the increase of overhang which they involve, but special chucks, in which this disadvantage is minimised, are often used, especially when it is necessary to change the drills in the course of normal operations. When deep holes of small diameter are to be drilled, for

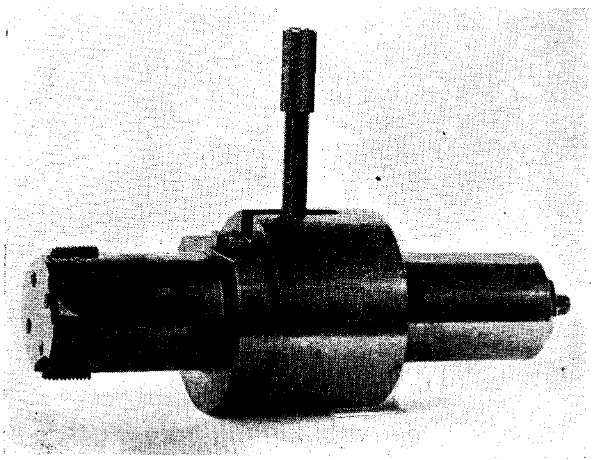


Centring and facing tool. (*Messrs. Alfred Herbert Ltd.*)

* *Continued from page 29, " M.E.," January 11, 1940.*

instance, it is usual to start with a short stubby drill, so as to minimise the risk of the hole "wandering" out of truth, and afterwards changing it for a longer one; sometimes three or four drills of varying lengths are employed in succession.

Lubrication and cooling of the drill is most important, and for holes of the size under discussion, the drill must be frequently backed out, to clear the chips and flood the cutting edges with coolant so as to avoid overheating. For specially high rates of drilling, the oil or cutting compound may be fed direct to the cutting edges by passages in the drill and its holder. It has in some cases been found possible to equip an ordinary twist drill with feeding pipes by brazing them along the flutes, but the amount of room thus taken up seriously impedes chip clearance, and it is generally found better to use a special drill, with

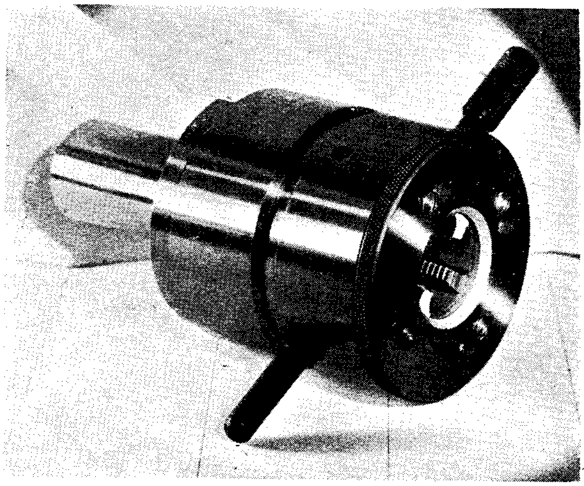


Coventry patent collapsing tap. (*Messrs. Alfred Herbert Ltd.*)

inserted cutters, and passages formed in the shank, at least for holes over 1″ diameter (Fig. 9).

A wide variety of tools for opening out and finishing drilled holes is encountered in capstan and turret lathe practice. Small holes are generally dealt with by means of machine reamers, which differ from hand reamers in having no "lead," or taper at the entering end, but cut mainly on the front, which is chamfered or rounded to distribute the cutting load and leave a smooth finish. These also must be kept well lubricated, but it is not generally advisable to back them out after they have started to cut; best results are usually obtained by running them straight in and out again without a pause. This applies to reamers used for final finishing, in which no imperfection of the surface, such as a ridge or scratch, can be tolerated.

Large holes are also reamered, in many cases, but the reamers employed are in most cases of the "shell" type, with inserted cutters, and adjustable for size within certain limits. Boring bars carrying either fixed or floating double-ended tools



Coventry self-opening diehead. (*Messrs. Alfred Herbert Ltd.*)

are also used extensively for finishing. While the ordinary methods of boring by single-point tools are usually too slow for rapid production, in straightforward work, it is sometimes necessary to employ them for recessing or undercutting holes to a larger diameter than that of entry. In such cases, the boring bar must be carried in a holder having a cross-traversing slide motion, unless the turret slide is equipped with cross traverse, which is not usual in ordinary capstan and turret lathes. Single-point tools are sometimes employed for finishing bores in cases where accuracy, rather than mere finish, is the prime consideration.

Screwcutting

The great majority of threaded work produced in capstan and turret lathes is cut by taps and dies, as this method is generally the most expeditious. High rates of production, however, impose very exacting duties on these tools, and they must not only be of the very best quality, but also kept very sharp, and properly backed off behind the cutting edges, to ensure clean cutting

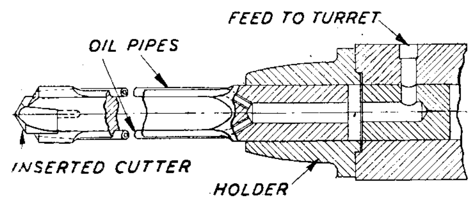


Fig. 9. Special drill, with inserted cutters and oil passages, for heavy drilling on capstan and turret lathes. (*Messrs. H. W. Ward and Co. Ltd.*)

and avoid the risk of stripping. The use of ground thread taps has enabled production to be considerably speeded up in recent years, and the same applies to similarly formed inserted cutters in the dies for external threads.

Solid taps and dies are, in some cases, carried in a holder having an adjustable overload clutch, which will allow them to slip if anything occurs to

impede their free cutting, or when they have cut the thread to the required distance or depth.

The delay involved by stopping and reversing the lathe can be avoided when tapping holes of 1″ dia. or over, or when cutting external threads of any size, by employing collapsing taps or self-opening die-heads. These ingenious tools incorporate inserted cutters, which are held in their cutting position by an internal cam mechanism. By means of a trip gear, operated either by a stop incorporated in the tool itself, or by the stop gear of the capstan slide, the cutters are released and retracted from the work when they have finished the cut. The Coventry patent collapsing taps and self-opening die-heads, shown here, are typical of the tools in this class. In addition to convenience and rapid operation, such tools have the advantage that the cutters are readily removable for sharpening, replacement, or changing to various size and pitch, and provision is also made for adjusting the diameter of the finished thread.

The "Tangic" series of die-heads, by Messrs. Alfred Herbert, Ltd., employs a special type of tangential chaser dies, in which the serrated cutting edges, instead of being formed on the end, as in the usual type of chaser, are formed along the entire length of one side. By this method, the re-grinding of the dies is greatly simplified, and they may readily be ground to the angle of cutting rake found most suitable for the material in hand; in addition to which, their working life is vastly increased, as the length of the serrated face can be much greater than that of the ordinary type of dies.

(To be continued)

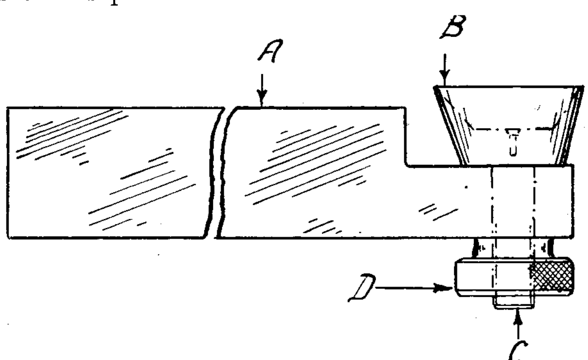
A Turning Tool for Leather and Fibres

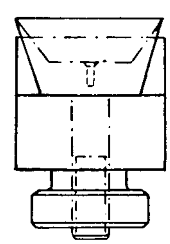
By W. M. Halliday

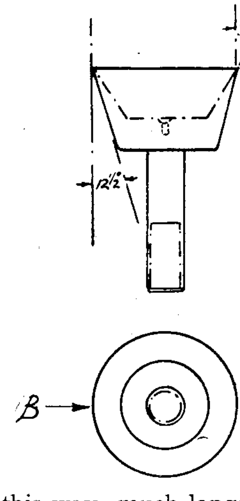
THE illustration shows an unusual type of lathe tool which has proved extremely useful in ensuring free cutting and smooth finish in connection with the turning of leathers and fibres in the lathe. Upon these materials the more orthodox kind of tool proved most unsuitable.

This type of tool possesses several advantages, i.e., longer life is obtained between re-grinds, the cutter piece is readily adjustable, and a very keen cutting edge is always presented to the work-face, whilst ample clearance is afforded for the dust and cuttings created.

Referring to sketch, *A* is a mild steel shank of rectangular or other suitable section. The dimensions of this part are such as will cover a con-







venient range of work sizes. One end of this shank, *A*, is thinned down to approximately half thickness to the seat for the cutter proper. A hole is drilled through this thinned portion to receive the stalk end of cutter, *B*.

As will be seen, *B* is the actual cutter, this being of good quality tool steel, of course. It is provided with a threaded stalk piece, as at *C*, this being a free rotating fit in the hole in *A*.

The other end of *B* is shaped as an inverted frusto-cone, the outside faces being inclined at an angle of approximately 12½°, whilst the dished-out portion have walls set at an angle of approximately 30°, as shown in dotted line at extreme right-hand view of this part. The inner and outer sides of this part are carried out to a knife edge. The cutter should then be well hardened, and afterwards ground or polished on its exterior.

D is a knurled-headed locking-nut provided for securing cutter, *B*, by its shank, *C*, to holder, *A*.

In use, this tool is operated in a normal manner, excepting that when the cutting edge becomes dulled, lock-nut, *D*, may be released so as to permit turning the round cutter, *B*, in order to present a fresh point to work; lock-nut then being tightened again. In this way, much longer life is possible to the cutting edge.

So as to facilitate such re-sharpening, it will be an advantage to provide small centre holes, one at bottom of dished portion, the other at end of stalk piece, *C*, thus enabling the cutter to be held between centres of a small cutter-grinding machine for skimming over the periphery of cutter portion so as to bring to a knife edge again.

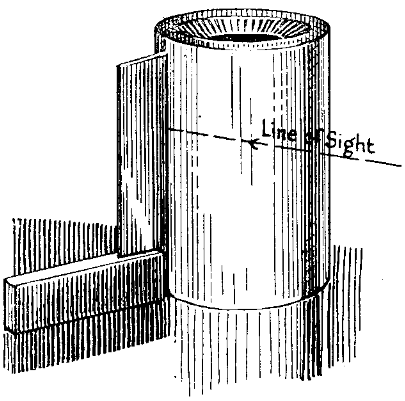
*Gauges and Gauging

A series of great value to engineers of all classes, particularly those who are engaged upon national service

By R. Barnard Way

THE measurement and setting-up of angles is a most important part of the work of the gauge-maker, and we will go into it now. We can say, at once, that the angles they have to deal with in the tool room are almost invariably "difficult" angles, and not the simpler sort of whole-degree angles. Consider the matter of the taper for instance. A perfectly straightforward taper of 2 inches to the foot represents an included angle of 9° 32′, and this will have to be tested and checked at some time during its manufacture. But this is to dive right in at the deep end a little too soon!

The simplest angle, and the most essential one in all engineering work, is the right-angle, which all the world knows to be one of 90 degrees. (We



Testing a square for accuracy by cylindrical gauge.

believe that it is now 100 degrees in Germany, though that need not concern us unduly.) Setting up a true right-angle is not as simple a matter as you might think, but the method need not really concern us here, we will be satisfied to have a good try square. If you have one, preserve it.

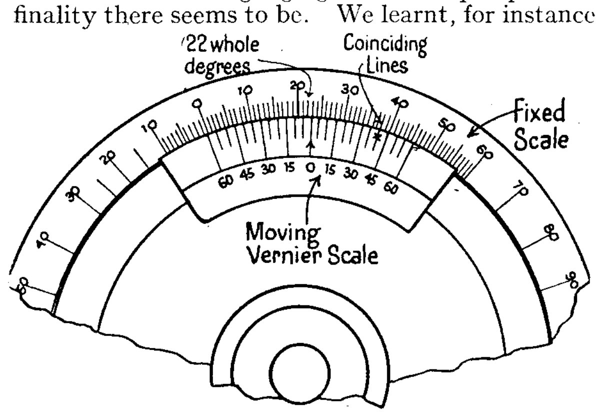
Every mechanic who uses a square, and every man of his hands *should* use one, ought to know how to check up the tool to assure himself that it is true, and should do so at frequent intervals. Here are some details that you should find of assistance in this direction. A good new square will probably be guaranteed correct to within 0.001″ to the foot; that is to say, the blade of a 12 inch square will not deviate more than one thousandth of an inch from the truth, reasonable enough for most work.

You can scribe a line with the chisel-edged scriber, working from a known true face, and then reverse the square, scribing a fresh line on top of the first one. If they agree, well and good, there is not much to bother about; that is a simple way of dealing with it, but you may need more exact information.

Then you can gather a collection of squares, not less than three, and pair them off with their stocks on the surface block and blades upwards. If they all agree, not much is wrong with any of them. The tests should be made against the light, for viewed thus the tiniest chinks will show light through, and so you get the best possible indication.

Many shops keep a testing cylinder for checking up right-angles. This is simply a cylinder with very accurately finished surfaces, top and bottom being absolutely square and slightly hollowed. Its weight keeps it firm on the surface table, and the square is brought up to it, stock flat, blade uppermost and truly vertical. If it is in good order, no light should be seen between blade edge and cylinder face, but so exacting a test is this that few squares will pass it. We recorded some way back in these articles that a chink no more than 0.0001″ shows as white light quite clearly, and less than a third of even that can be seen as coloured light. The figure just quoted is ten times the degree of accuracy guaranteed for most ordinary squares.

Other methods of testing of a much more accurate nature will be dealt with at a later stage, these we have given will tell you that the square is out of truth, but if you want to know just by how much, then more precise methods must be employed. In fact, the deeper one gets into this business of limit gauging the less prospect of finality there seems to be. We learnt, for instance



The protractor vernier.

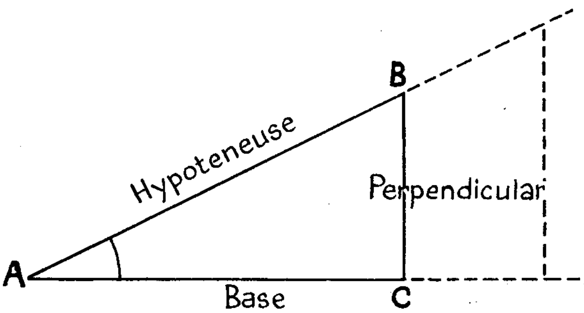
(though the story is old now) that during the late war the inch standards employed at the Enfield Small Arms factory differed in length from those employed by the Admiralty. One can imagine

* *Continued from page 19, "M.E.," January 4, 1940.*

the arguments that might have ensued, and probably did, but the best part of the joke was that both of them were wrong.

The so-called combination square is a useful item of equipment, that assists in the setting-up of the simple angles. A graduated steel rule has at one end a sliding head with one right-angle surface and one 45° surface, and at the other a right-angle V that makes centring easy on the ends of shafts or other circular objects. In the centre is a rotating protractor graduated in whole degrees so that the movable plane can be set at any angle. A spirit level is fitted in this centre head, and another one at right angles in the square head.

There are other devices, such as the bevel protractor, a detail of which we illustrate. This, if it is of the better sort, will have a vernier, enabling the user to read off angles to five minutes, that is one-twelfth of a degree. For the benefit of those to whom this useful device may still be a



The right-angled triangle.

mystery, we put in an enlargement of the vernier, and a few simple notes on the reading of its indications.

The circular scale is, of course, fixed, and is graduated in four right-angles, zero at top and bottom, and 90° at right and left, the protractor being set up as shown. The rotating bevel blade carries a plate bearing upon the graduated scale, and on this plate are graduations covering something more than 45°. These are marked right and left of a centre zero, twelve on each side, each one representing five minutes of angle. To read off the angle shown, observe the nearest whole number of degrees above the zero line, in this case 22°, though the angle is obviously more than this. Now look along to the right until you see a line on the movable plate that coincides with one on the fixed scale ; read back on that line to the number and there you have the minutes of angle to the nearest 5. In this case the graduation is between the numbers, but is easily seen to be 40, so the angle represented is 22° 40′.

There is no great difficulty in setting any angle on the scale, if you remember the rules for reading. If the whole number of degrees is to the left of the zero on the fixed scale, then minutes are read off on the left side of the zero on the moving scale. That is all there is to the protractor vernier.

In the beginning of this article we mentioned an angle of 9° 32′ ; now, as this gives an odd number of minutes, we cannot set our protractor scale with precision to it, and so some other method will be needed. Here is where a little trigonometry comes in. There is no need to get scared at this word, it is the science that deals with angles, and all we want to know about it is the simplest possible part of it, or nearly so. After all, every proper mechanic will know, for instance, that if you make up a triangle with the sides 3, 4 and 5 inches (or feet, just as you like), then the angle opposite the longest side is a right-angle exactly. Well, that is trigonometry too, and nobody gets alarmed about it.

We have drawn a diagram here, showing a right-angled triangle, marked in the customary style ABC. The angle we are interested in is at the point A, and is more correctly described as the angle BAC. The long side BA is called the hypoteneuse, and the shortest side (in this case) BC is called the perpendicular, because it is drawn perpendicular to the base AC. Now a little thought will perhaps convince you that the *proportions* of these sides will be the same, however long we make them, it is the angle BAC that controls their proportion one to the other. At any rate it is so, and experiment will soon demonstrate it to be the case.

Trigonometry has seized hold of this idea and has set up a series of proportions of these sides for all angles, to the nearest minute. There are six of these proportions altogether, but we will be content with just one of them. That is the proportion of the perpendicular side to the long hypoteneuse side, $\frac{BC}{BA}$, known as the Sine.

Most workshop handbooks include a table of sines of angles ; reference to ours can be quickly made. You will see down one side are angles in whole degrees from 0° to 44°, and on the next page from 45° to 89°. There will be seven columns of five figure numbers, headed 0′ to 60′ in jumps of 10′ each. Take no notice whatever of the word Cosine at the bottom of the table, nor of the column of whole degrees at the right, they do not concern us at all.

Looking along the line opposite 9°, and in the 30′ column, we see 0.16504. That is the sine of 9° 30′, but we want 9° 32′, so look at the next figure, under the 9° 40′ column, this is 0.16791. The difference between these two is 0.00287, and as that represents 10′, if we take one-fifth of this and add it to the sine of 9° 30′, the answer is 0.16561. Put it down thus :—

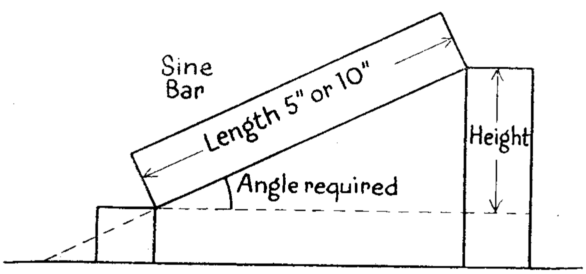
sine 9°40′ is 0.16791	1/5 of difference =	0.00057
sine 9′30′ is 0.16504	sine 9°30′	0.16504
difference—0.00287	sine 9°32′	0.16561

Now we know the proportion $\frac{BC}{BA}$ for an angle of 9° 32′, it is easy to draw that angle, simply by ordinary geometrical means. If we take a

hypoteneuse of one inch, and a perpendicular side of 0.16561 (a little too accurate for most scales of course) the triangle will include an angle of 9° 32′. It will be easier to make the sides 10 inches and 1.656 inches.

However, we do not want to draw it on paper, but to set it up on some mechanical contrivance that will be rigid enough for us to use as a gauge, and this is quite easy. We require what is known as a sine bar, an accurately finished steel bar, preferably about 12 inches in length. There are various forms of sine bar, every gauge manufacturer has his own particular design, and we cannot find room for them all, but here are one or two. The principle is the thing, and that should be clear shortly.

Imagine, first of all, a perfectly straight and true bar, 10 inches long, one end supported on the surface block, and the other end lifted up, so that its corner is just exactly 1.656 inches above the table. Here then is your triangle, well and truly established, the small angle being 9° 32′, and the taper, 2 inches to the foot. There can be very little real difficulty about that, we are sure.

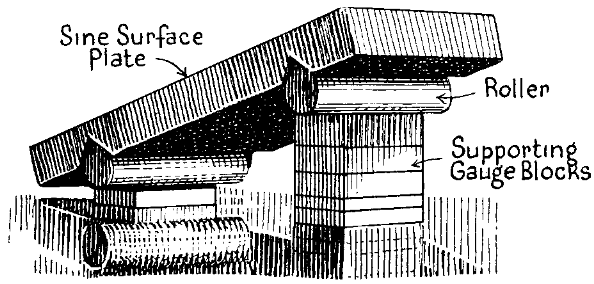


The sine bar in principle.

To tilt up the bar so that its extreme corner was perched precariously as we have shown it would be asking for trouble, so some more secure arrangement is necessary. The Pratt and Whitney sine bar is one of the simplest we have seen, and this has two right-angle V notches cut in the bottom face, the apexes of the V's are exactly 5 or 10 inches apart. Perfectly true cylindrical rollers support the bar clear of the surface block, these provide a seating for the V notches, which are as nearly absolutely parallel as human ingenuity can make them.

It is desirable to have the bar well clear of the surface, so if we lay one roller on a gauge block 1 inch in thickness, and the other one on a stack made up to 2.6561 inches (adding one inch to the 1.6561 to make up for the extra inch at the other end), we shall have a reasonably secure set-up. The stack of 2.6561 inches can be assembled from 2″, 0.300″, 0.146″, 0.110″, and 0.1001″.

The Pitter sine bar is 10 inches long between pivot centres, and has two blocks pivoted, one at each end, for supports. The heights of these blocks are exactly adjusted so that the bar is



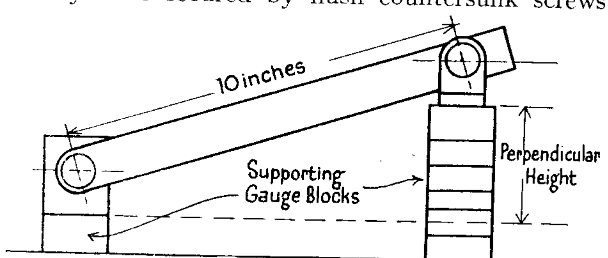
The Pratt and Whitney sine block in use.

truly parallel with the supporting surface plate. Their under faces are lap finished so that they will wring on to the supporting gauge blocks, thus providing a very secure set-up. The process of erecting is exactly the same as for the previous one.

If your sine bar is only 5 inches long, as many are, you only have to multiply the sine of the angle by 5 instead of 10. In the case we have been dealing with so far, the high end must then be lifted 0.16561 + 5 = 0.82805 inches higher than the low end, or, adding one inch at each end for clearance underneath, 1.8280 inches.

Not every tool-room possesses gauge blocks, so the writer thinks it as well to add details of the arrangement still in general employment, an example of which he made for use many years ago. It can be made by any good mechanic who can put a nice finish on a job. The methods of making it are not our strict concern here, those must be left to the individual, and are partly governed by the resources he has available. There is no question at all about the utility of the tool. The sketch shows the general arrangement well enough.

The bar itself is 6 inches long, with a hardened steel plug at each end and each plug exactly one inch in diameter, centred exactly 5 inches apart. If the securing holes for the plugs are ovalled out a little, this assists in the final adjustment by micrometer before securing them. In our case they were secured by flush countersunk screws,



The Pitter sine bar.

tapped into holes drilled through the plugs, the ends being cut off flush and a fine finish put on.

The use of fine micrometer gauges of various types will be dealt with later, a thorough knowledge of these indispensable aids is one of the first essentials to every man who aspires to the tool room.

(*Continued on page* 72)

*Model Traction Motors and Control Gear

The construction of a motor suitable for locomotives and other models

By J. Gordon Hall

IT has always been the writer's aim never to include in his published designs components which are not readily obtainable by readers, and with this object in view a great deal of time and trouble has been taken to ensure a source of supply of such parts in the small individual quantities likely to be ordered by readers of the " M.E."

It is only natural that the outbreak of hostilities upset things very considerably in this direction; manufacturers, busy on Government work, were not found to be very enthusiastic about supplies, but a certain amount of coaxing has rendered the position much better than was anticipated; supplies of all laminations, etc., called for in the motors to be described in this series will shortly be forthcoming, and in the meantime the writer holds a small stock, normally kept for experimental purposes, which will be available to any reader who cares to communicate with him, c/o this paper, while such stock lasts, and a list of firms carrying stocks of the specified parts will be published in the very near future.

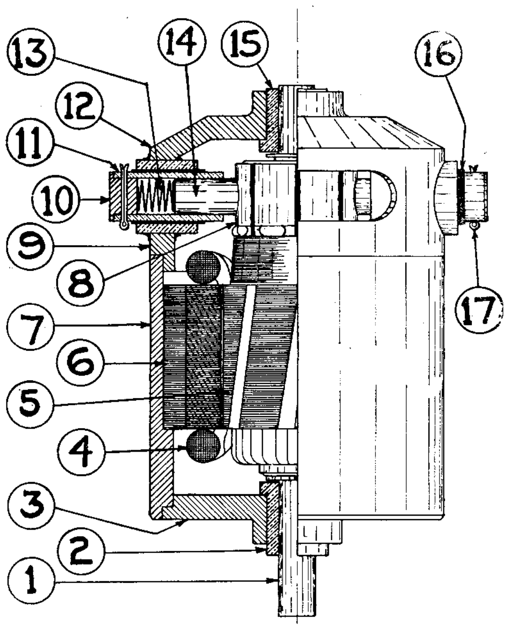


Fig. 1. Part sectional general arrangement (scale full size).

It may here be pointed out that simple armature and field laminations may be made without a press or press tools if care and patience are exercised. Semi-enclosed armature slots and complicated shapes of field laminations are rather beyond the abilities of the average reader, but open slot armature laminations and simple field laminations may be made in the following manner.

" Tinplate " of suitable gauge is cut roughly to size—sufficient pieces for the number of laminations required—and having been very thoroughly flattened they are stacked together and bound with wire tightly after smearing them over with fluxite.

They are then sweated together into a solid block, and machined, drilled and filed to shape, after which the block is heated, the laminations separated, solder wiped off, and when cool they are painted—for insulation—one side.

It is proposed to include in this series a motor utilising laminations so made, and the writer is at present working on such a design, which will be published when space permits.

The motor to be first described utilises laminations No. 6, Fig. 3, may be wound for a variety of voltages (windings will be given later), and will operate on either a.c. or d.c.

It is of suitable size to fit in the boiler barrel of some No. " 0 " gauge locos., and may be used for motor-bogies up to No. " 1 " gauge or even $2\frac{1}{2}''$ gauge if several bogies are included in the train.

As this little motor has a decided " scale " appearance, it will be found particularly suitable for model cranes, excavators or similar models

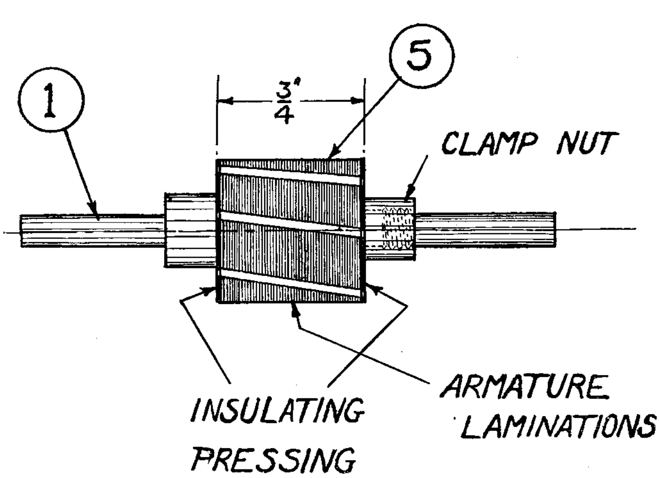


Fig. 2. Armature laminations assembled to shaft.

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* *Continued from page* 210, " *M.E.*," *Vol.* 81, *August* 17, 1939.

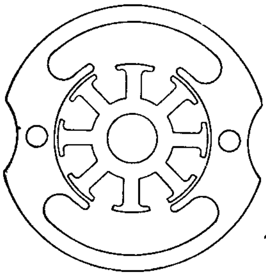
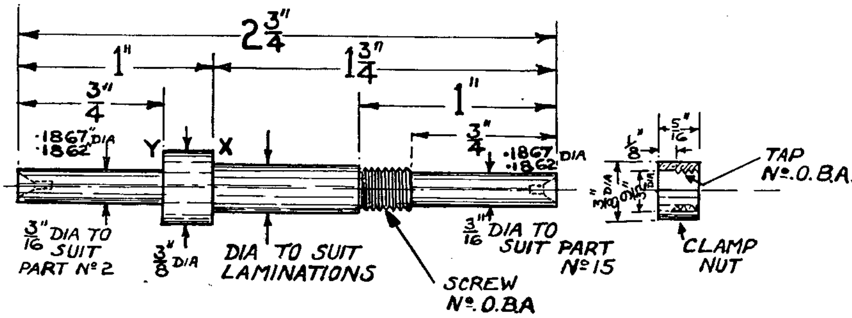


Fig. 3. No. 6. Full size.



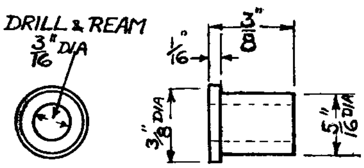
Part No. 1. Shaft.

where the motor is exposed to view and must look like the real thing.

Foot-steps, or holding-down lugs, may be cast solid with the carcase, Part No. 7, or screwed or pinned and sweated thereto if the carcase be built up; either method may be adopted, though the writer strongly advocates castings in aluminium for the carcase and end-plate, Part No. 3 being cast solid with Part No. 7, and the other end-plate, Part No. 12, being a separate casting.

These components furnish very simple examples of pattern-making, and instructions for making these patterns will be given in a later instalment; also, it is possible for so small a volume of metal to be melted over a blowlamp and the casting done at home.

Fig. 1 gives a half-sectional general arrange-



Part No. 2. Drive end bush.

ment, with the various part numbers shown; these parts will in future be referred to by these numbers.

The first job to tackle is the armature and bearing bushes, Part Nos. 1, 2, 5 and 15.

Commence with Part Nos. 2 and 15, the bushes; these should be turned from gunmetal rod, first drilling and reaming with a dead 3/16″ reamer, and then turning the outsides on a true-running mandrel, taking care that the bore is smooth and exact size, and that the outside is true with the bore; no further instructions are required for machining these parts.

Having completed the bushes, the next item is the shaft and lamination clamp-nut, Part No. 1.

Cut off and square the ends of $2\frac{3}{4}''$ of $\frac{3}{8}''$ dia. mild steel rod, chuck and centre each end with a small "Slocombe" drill, clamp on a carrier at one end and turn—between the centres—to dimension as far as shoulder "X," using an armature lamination to gauge the centre portion; the lamination should be a nice push fit thereon.

Turn the journal portion this end to a nice running fit in Part No. 15. For those readers who use a "mike"—and I hope there are many—I have given the decimal limits suitable for a running fit in a dead 3/16″ reamed hole.

Now regarding the screwed portion. It is advisable, if the job is done on a screwcutting lathe, to start the screwing operation by taking a screw cut with the change-wheels set up for the purpose, and finish with a die, because this ensures the thread being true, but this operation can be dispensed with provided due care is taken to help the die up against the tailstock, feeding this in as the die travels forward, and using plenty of cutting oil on the job.

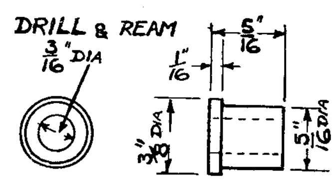
It will be found that to be a good fit to the laminations the shaft must be left over $\frac{1}{4}''$ dia.—actually 7 millimetres—so it will be necessary to turn the screwed portion down to $\frac{1}{4}''$ dia. before screwing.

When this end of the shaft is complete, it is reversed in the lathe, and the journal up to shoulder "Y" is turned a running fit in Part No. 2.

The clamp-nut is turned from a piece of $\frac{3}{8}''$ dia. brass rod and should be easily screwed on the shaft with the fingers.

The laminations may now be assembled to the shaft (see Fig. 2).

Part No. 15. Com. end bush.



As shown, an insulating pressing should be placed at either end of the stack of laminations; the insulating pressings are made from the same tool as the laminations, but pressed out of fibre or prespahn.

A careful examination of the laminations will reveal a tiny notch at the bottom of one slot. All these notches should be in line, and all the laminations the same side out—one side will be found to have been treated with a greyish coloured insulating paint.

After the laminations have been threaded on the

shaft, and before finally locking up the clamp-nut, care should be taken that the slots are exactly in line, a piece of rod, a close fit in the slots, should be threaded through one slot and the laminations slewed to approximately the angle shown in Fig. 2—you need not be exact about this.

Keep the piece of rod in the slot while lightening up the clamp-nut (with a pair of strong pliers) as hard as possible without stripping the thread; if necessary, slip a washer over the shaft and between the insulating pressing and the clamp-nut if the former shows too much tendency to turn with the latter. It is as well to drill through the clamp-nut and shaft after assembly, and drive in a pin, afterwards cut off flush, to key the clamp-nut and prevent it working loose.

When the armature is assembled thus, examine carefully for, and remove, any sharp edges or "raggs" from the slots.

The armature is now ready for winding and may be put aside until later.

Assembling the Field Laminations

This operation is very simple. A sufficiency of laminations are stacked, looking out as in the case of the armature laminations for the indicator notch, threaded on a piece of steel rod turned to fit the bore, and riveted up with a pair of soft iron rivets made from iron wire of a gauge to fit the two holes in the laminations snugly. Care should be taken that the laminations are exactly square with the bore, and in line.

I see I have omitted one point in connection with Part Nos. 2 and 15, the bushes. The outside dimension of these is given as 5/16" dia., as they are to be a press fit into the carcase and end-plate they should be left full.

If their housings are reamed out with a dead 5/16" dia. reamer, the decimal limits should be 0.3122" to 0.3117"—this for the benefit of readers "mike conscious."

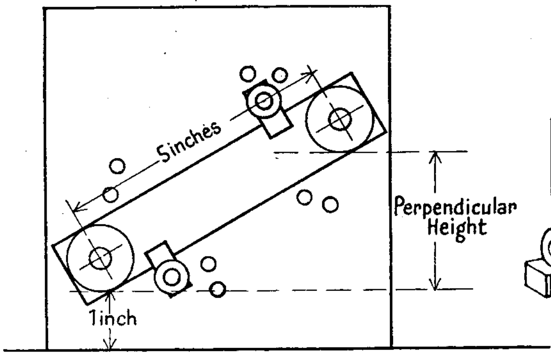
(To be continued)

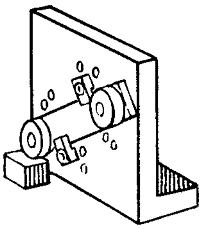
Gauges and Gauging

(Continued from page 69)

To clamp the bar on to the angle plate, two clamps with securing screws that will run into the tapped holes in the plate are needed. The holes must be drilled in various places to provide for the different positions of the bar, and also to ensure a clear length of bar at all settings. It is also a prime necessity that the plate should be finished truly square, and we mean *square*, both as to its shape and also with regard to the base upon which it stands.

After what we have already said, it ought to be clear how to set the bar, but it will be a great





A sine bar that needs no gauge blocks.

help if you provide also a square block, with one pair of its faces truly one inch apart, the others can be what you like, so long as they cannot be mistaken for one inch. When setting the bar, this one inch will be placed under the lower plug, and the plug must seat on it exactly. To adjust the high plug you will have to use an outside caliper, set with the spacing of its points equal to one inch added to the amount of the perpendicular, and once this is established, the clamp can be tightened up. A micrometer caliper is really essential for accurate work, but quite reasonable results can be had working to the nearest hundredth of an inch. If micrometer tools are not available with large openings, ordinary screw calipers will serve, but it is not much use expecting extreme accuracy, and we hate the expression "near enough." Limit gauging does not admit it at all.

The thoughtful student will, we hope, have given enough consideration to this sine bar principle to see where the catch somes in. It is very fairly accurate for angles up to 45°, but after that the steepness of the slope begins to tell, and inaccuracy obtrudes itself. You have only to think of setting up a right-angle by sine bar method to convince yourself of that. A right-angle is the extreme case possible, and the error there reaches a maximum. The remedy is quite simple, for all you have to do with a gauge of the plate sort we have just seen, is to set up the sine bar at an angle obtained by subtracting what we want from 90°, and turning the plate on its side. Thus, if the angle we have to establish is 80° 28', obviously too steep for accuracy by ordinary methods, subtract this from 90°, which gives us that angle of 9° 32' again, and put that on. Set the back plate at right-angles.

Tackling this problem with other types of sine bar, we have to use a right-angle block on the surface table, and build out from the vertical face of this.

Under ideal circumstances, a sine bar 5 inches long will give an accuracy of ± 10 seconds of angle, and a 10 inch bar will halve this. A second of angle is the one sixtieth part of one minute, and we have only claimed exactness to this extent.

(To be continued)

Queries and Replies

Enquiries from readers, either on technical matters directly connected with model engineering, or referring to supplies or trade services, are dealt with in this department. Each letter must be accompanied by a coupon from the current issue, with a stamped addressed envelope, and addressed: "Queries and Service," THE MODEL ENGINEER, 60 Kingsway, London, W.C.2.

Queries of a practical character, within the scope of this journal, and capable of being dealt with in a brief reply, will be answered free of charge.

More involved technical queries, requiring special investigation or research, will be dealt with according to their merits, in respect of their general interest to readers, such as by a short explanatory article in an early issue. In some cases, the letters may be published, inviting the assistance of other readers.

In cases where the technical information required involves the services of a specialist, or outside consultant, a fee will be charged depending upon the time and trouble involved. The amount estimated will be quoted before dealing with the query.

Only one general subject can be dealt with in a single query; but subdivision of its details into not more than five separate questions is permissible. In no case can purely hypothetical queries, such as examination questions, be considered as within the scope of this service.

7,715.—Winding a Small Induction Motor—E.E.S. (Armley)

Q.—I have a motor which I wish to wind to drive a 3″ screwcutting lathe. The stator consists of a core, 5½″ dia. × 3″ long and 2¾″ bore, with 18 slots, 17/32″ × 15/32″, and the rotor, 2¾″ dia. × 3″ long, with 16 holes, 5/16″ dia. (slotted into bore). Can you supply windings for 200 volt, 50 cycle, 1-phase, 1,400 r.p.m., with suitable section of end rings for the rotor, which I propose to bronze-weld to 5/16″ copper bars? Please state approximate power I can expect from above.

A.—A motor of the dimensions you name should be capable of developing ¼-b.h.p. at 1,400 r.p.m. on a 200 volt, 50 cycle, single-phase circuit. The holes in the rotor are unnecessarily large in diameter, and one layer of 10 mil. leatheroid might, with advantage, be wrapped round the copper bars before brazing up the end rings, so that they fit tightly, using rods ¼″ diameter. The end rings themselves should be 1/16″ thick by ⅝″ radial width. Eighteen slots in the stator is a very awkward number for a 4-pole winding, such as is necessary to give a speed of 1,400 r.p.m., as it would result in a fractional number of slots per pole group or else an unsymmetrical distribution of coils. If there is no great objection to a speed of 2,800 r.p.m. instead of 1,400 r.p.m., the stator lends itself much better to 2-pole grouping, in which case there would be nine slots per pole, eight of which would be occupied by the main running winding, and the other slot for the starting coils. The main coils may consist of 42 turns each of No. 21 s.w.g., eight coils in all or four per pole, distributed in slots 1-9, 2-8, 3-7 and 4-6. No. 5 slot will be occupied by two starting coils, diverging right and left, each containing about 60 turns of No. 27 s.w.g. A good quality of enamel covering should be satisfactory, but enamel and single silk is safer to employ.

7,706.—Re-Winding an A.C. Motor—G.H.T. (Ipswich)

Q.—I have purchased one of your handbooks, i.e., "Small Alternating Current Motors," by A. H. Avery, as I had been informed that this would enable me to re-wind a motor. Unfortunately, I doubt whether one would be able to do so from the information given.

In the first place, on page 49, 666 turns are shown as being necessary *per pole*, but in the example at the foot of the same page, 666 turns are quoted as the *total* number for the stator.

On page 50, starting coils are mentioned, but it does not state how many are required, or whether they are connected in series or parallel with the main winding, or, further, how they are controlled.

I have a Hopkinson 2-h.p. 3-phase 400 volt squirrel-cage motor, 1,400 r.p.m., which I wish to re-wind for 1-h.p., 1,500 r.p.m., approximately 230 volt, 1-phase. This has 36 slots on the stator, and I propose using 32 of these, making a 4-pole field which will leave four slots vacant. The effective area of the stator is 20 sq. in., and I make the number of turns per pole 50, which gives, say, 12 per slot.

Presumably I shall require four starting coils, each displaced half a pole pitch from the main poles, but I am not clear how these are connected.

A.—The calculations referred to show the total number of conductors for the stator, assuming it to have a 4-pole winding. The small handbook in question makes no claim to go into the whole theory of winding calculations, as it is a subject altogether too complex to be dealt with in this scope. Reference should be made by those requiring further guidance to such works as "Connecting Induction Motors," by A. M. Dudley, or to "Re-winding Small Motors," by Braymer & Roe. Starting coils are invariably coupled in parallel with the running coils, and are in use only for a few moments until the motor speeds up, after which they are cut out of action. Detailed calculations for changing your 3-phase winding to 1-phase can only be dealt with satisfactorily from dimensioned drawings of the stator and rotor, but you will find all necessary procedure in the first named of the above books.

7,723.—Balancing—F.B. (Box 34, Essex, Ont., Canada)

Q.—Instead of putting balance weights on the crankshaft, is it not just as practical to put same on the flywheel, or drill flywheel to take care of piston and connecting-rod; in other words, is there a special reason that the balance is put on the crank web?

A.—The balance weights on a crankshaft should always be placed as close to the plane of the crankpin as possible, and inside the shaft bearings; by this means, the unbalanced forces are counteracted close to their source and are not transmitted through the shaft. If the balance weights are located some distance along the shaft, and the remote side of the bearings, two undesirable effects are set up; first, the hammering effect of unbalance is transmitted to the bearings, setting up undue shock load, and second, a rocking "couple" is set up in the shaft; the effect of the weight on the crankpin on one side, and the balance weight on the other, acts like a see-saw, with the centre of the bearing as a pivot, so that the latter rapidly wears bell-mouthed. A double-ended shaft, balanced in this way, would have the rocking couples neutralised if the shaft was perfectly rigid; but no crankshaft is, in practice, a truly rigid structure. Many engines have been balanced in this way, but it is a most significant fact that the method is never employed in engines of high speed and performance.

Practical Letters

Large-Scale Locomotives

DEAR SIR,—To me, it appears that Mr. E. W. Twining has rather missed the point of this discussion. He cannot have had much recent experience with miniature railways built for public service, or he would have noticed that, even when the locomotives derive their motive power from petrol or oil engines, much trouble and expense are usually applied to camouflaging the superstructure into some reasonable semblance of a "Flying Scotsman," "Princess Royal" or other favourite prototype.

This is a horrid thought, I know; but I suggest that it has goaded the "steam" men into concentrating their ingenuity upon the problem of reducing the cost and increasing the efficiency of the steam-propelled miniature locomotive, at one and the same time.

The undoubted success that has rewarded their efforts is, now, fairly common knowledge. And these men know quite well that, even with their "free-lance" designs, they must keep within a very close approximation of prototype proportions if their locomotives are to be of the greatest attraction to the public. If not, the whole idea of the *model* locomotive simply vanishes!

Yours faithfully,

London, W.C.1. "CHURCHWARDIAN."

DEAR SIR,—I am glad to see in the "M.E." of December 14th that at least two more readers have expressed their opinions re the design of large-scale locomotives. Mr. Burgoyne and Mr. Shephard are both right, in my opinion, in saying that the success of any such engine depends greatly on correctly proportioned boiler, cylinders and blast pipe, and well designed and built valve-gear, correctly set.

There is certainly no reason for saying that a free-lance loco. so designed and built cannot be as great a success as a miniature copy of a definite prototype.

In the smaller gauges, one sees such examples as Mr. Crebbin's fine locos., of free-lance design, and Mr. Keiller's smaller but highly efficient little engines; *but*, how many would-be builders have the engineering knowledge and practical experience of these two well-known model loco. experts? There are others, it is true, outside the professional loco. engineering circle, but men of such qualifications are, comparatively speaking, few and far between as to the vast mass of enthusiasts whose technical knowledge is small, and who, in many cases, are also not expert at either drawing or fitting and turning.

If a definite prototype is taken and scaled down, the correct proportions have already been determined by the C.M.E.'s of our great railways; so, to my mind, there is less risk of a mistake being made, which is likely to impair the efficiency of the little engine, than if the builder puts in a bit of one type and a bit of another, introducing all his pet ideas as well, which may or may not make for efficiency, but often, I fear, does not. The result, more often than not, is unlovely to look upon and displeasing to the driver, and frequently inefficient as well.

Mr. Sheppard surely cannot see "Swindon" proportions in S.B. & C.R. *Silver Jubilee* and *Edward VIII*. They are very good free-lance locos. of their kind, and the top feeds, chimneys and *Edward VIII's* valve casing and smokebox have a smack of G.W.R. about them; but take the valve travel, the length of the firebox in proportion to the length of the boiler barrel and the grate area.

They do good work well as they are, but re-build one of them to true "Swindon" proportions, and I think you would see a vast difference in her performance. With a G.W.R. boiler, valve-gear and valve-setting, they would probably steam against one injector, the limit of their run depending solely on how far a tender of water would take them; probably from six to eight miles, fully loaded.

I have run many miles on the little G.W.R. Wolverhampton tanks, and no one who has worked on them and on S.B. & C.R. 0-6-0 T "3008" could fail to be struck with her great likeness to these old engines, both in proportion and performance.

In performance, she puts me in mind of the little Wolverhampton saddle-tanks of the 1901 class. No one really knew what those little engines would pull and stand up to when occasion demanded a special effort, and like a "Brighton Terrier," if one came to a stand with a train no other engine in the country of similar size would re-start the load unassisted.

The way "3008" tackled nine coaches with 63 passengers and the driver behind her was worthy of the G.W.R.; for even so she had an enormous margin of power to spare, and the one slip she made in starting from Cove Wood was in reality due to rough handling of the regulator, and could have been avoided had I not flown at the load to see how she would accelerate with a really heavy train.

The likeness certainly does not end with the exterior in this case. True, certain details are not quite correct, and Walschaerts valve-gear is used in place of Stephenson's, doubtless to give more space underneath, but from the working of the engine at any given point of cut-off, the valve-setting is very near the original except for the fixed lead.

In answer to Mr. Sheppard, I thought we were dealing with "Large-Scale Locos." not glass-case models, and believe it is usual where actual work is to be performed to make such modifications as are needed to stand up to hard wear and tear, even in a scale model. If the prototype chosen be that of an old-timer as in the case of my 5″ gauge G.W.R. "Armstrong" 0-6-0, the best results may be obtained by fitting a modernised valve-gear in place of the original design.

In regard to that on my own engine, experts in the persons of Mr. J. N. Maskelyne and Mr. G. S. Willoughby very kindly undertook this for me, and I am deeply indebted to both these friends for so generously putting their best into the designing of the engine.

I have not seen Mr. Burgoyne's line or engines, and it would be a great pleasure to do so if he will allow me at some future date.

Yours faithfully,

Plymouth. A. J. MAXWELL.

Dear Sir,—In the December 21st issue of The Model Engineer you invite comments on certain rival ideas concerning "true scale" versus "free-lance" model locomotives. The controversy does not interest me in the slightest, but it does arouse wonder why so much time and skill and printer's ink is devoted year after year to the cult of just "copying" something with which everyone is familiar. "Exercises" to only display skill are surely not very satisfying. Would not this skill and painstaking effort be better employed in trying out ideas, however embryo, comparing notes with others, confessing failures, seeking reasons and advice, putting forward ideas for discussion and development, etc.? Out of this would surely come some valuable new motive, some suggestion of originality, giving food for thought and action to your readers—or at any rate, to some of them. How much better off is the world when someone, after years of work, completes one more model locomotive "true to scale"? Especially when, as you suggest, it is then put in a glass case to be looked at and admired. Not much urge in this for those with a bent for experiment and exploration of fresh fields.

Yours faithfully,

Woodford Green. A. W. Garnett.

Classification of Model Speed Boats

Dear Sir,—I am pleased to note that several readers have expressed opinions on the above subject, but after having carefully studied all their letters, I am rather doubtful whether we are any nearer to finding a true solution to the problems originally discussed. The most important bone of contention, of course, is whether "C" class boats, both steam and petrol, should be definitely restricted to 7 lb., or whether extra weight concessions should be allowed for the steam boats to match those allowed in recent years for petrol boats; but although a good deal of discussion has taken place round the question of whether the 7 lb. limit is a fair one for petrol boats, I am very sorry to note that the case for steam boats, which has been put very strongly before the M.P.B.A., has scarcely been touched upon in this discussion.

One thing I very much deplore about the classification problem is that, after drawing up fairly simple rules, which worked quite well in this country and were almost universally adopted abroad, we should have found it necessary to get out of step with everybody else and revert to a state of chaos, from which there seems little hope of escape. For this reason, if for no other, I am in favour of adhering to the original 7 lb. limit for all boats in "C" class, irrespective of how they are driven. It has been amply proved that really fast and seaworthy boats can be built within this limit, and there is also a fair amount of evidence that power/weight ratio is an important factor in speed boat performance.

In the light of these considerations, I am in complete agreement with Mr. Rankine, but I do not entirely share his view that this makes weight restrictions unnecessary. On the other hand, something in the nature of rigid restriction is necessary for the segregation of classes, and to avoid complete chaos in general design. If one sets out to design and build a boat with no idea whatever of limits in any direction, or comparison with other potential competing craft, the result is very likely to be little more than a freak. Healthy restrictions are conducive to progress, and nearly all designers do their best work when they are tied down to certain rigid specifications.

For instance, if one may take an analogy from other competitive fields, take the effect of the horsepower, or, more correctly, engine capacity, tax imposed on cars many years ago in this country. Many engineers believed that it would paralyse industry; but, while nobody would claim that it has been an unmixed blessing, it has certainly caused attention to be directed to the potentialities of light cars and small-capacity engines. As a result, the power obtainable from small engines has been increased out of all recognition, and some marvellous speed performances have been attained by light cars. It is quite true to say that these would have been just as truly possible had there been no such thing as a capacity tax, but it is a fair assumption to suggest that, as very little attention would have been paid to this line of development, they would probably never have happened.

Quite frankly, it must be admitted that we have been inclined to neglect the development of really light engines of recent years, and, in particular, that of the high power two-stroke, which seems, on the face of it, to offer the best prospects in this direction. I do not exclude myself from this accusation, but at the same time claim that I have some excuse, because my policy has been very largely dictated by popular taste; my attempts, several years ago, to convince people that lightweight two-stroke engines would drive speed boats were little more than a dismal failure. And at the present day, I find it impossible to abolish the idea that an ignition coil weighing about 1 lb., and an accumulator which is heavier still, are necessary in a speed boat.

While I have no intention of going all anti-British over this question of weight limits, I would call attention to the rapid progress which has been made by our comrades across the Atlantic with lightweight model speed boats, particularly in "C" and "D" classes. So far as I am aware, they have never yet raised a quibble about the 7 lb. limit, but have gone ahead and built their boats to conform with it. I have always felt that if we allow these boats to be increased in weight, the result will be a steady degeneration in design. The constructor who cannot build down to 7 lb. this year will find it impossible to keep within 8 lb. next year, and so on *ad infinitum*.

I agree with Mr. J. C. Hudson that accurate tests of hulls, as well as engines, is highly desirable, and I applaud the good work he has been doing for years in this direction, without much credit or even recognition. For myself, I am very sorry that it has been necessary for me to revert to the role of armchair critic, at least for the time being, but I sincerely hope that in spite of the increasing number of irons I have in the fire, I may be able to take an active part in model speed boat development again in due course.

Yours faithfully,

London, S.E. Edgar T. Westbury.

[Mr. Westbury has perused all the letters that we have received on this subject. Some of these letters we have published; but Mr. Westbury's further comments, given above, may be taken as a summing-up of the matter as it now stands.—Ed., "M.E."]

Loco. Coal

DEAR SIR,—I was very pleased to see that my article on various coals I tested on my railway has been of interest to readers. I should be very pleased to let Mr. Perren have a run on my railway with his engine, but I fear that the curves might be too sharp for his engine. My maximum curves are 15 ft. radius, and the minimum one is 6 ft. radius, but a portion of my track can be run over continuously with 9 ft. radius curves.

I agree with "L.B.S.C." that the full-size locomotive has to burn anything, but I believe I am right in saying that some coal that the fireman has to use causes a lot of locomotive esperanto to be used on the footplate. "L.B.S.C." has kindly sent me a sample which he wants me to try, and from his note in the "M.E." it looks as if it is Phurnod. Curiously enough, I am using Phurnod at the present time for my domestic boiler. As a rule I use Phurnacite for this purpose, which is a composition made up, I believe, of Phurnod, but this composition is perfectly useless on my engines, while, on the other hand, Phurnod is a good burning coal, and it was my intention to try some on my models. As soon as a decent day comes along I am, most certainly, going to try "L.B.S.C.'s" sample. The Ford Patent Compressed Charcoal he sent me some years ago was excellent but, unfortunately, it soon burned away; it was child's play to keep the fire going with it.

Yours faithfully,

Bishop's Stortford. VICTOR B. HARRISON.

Reports of Meetings

The Society of Model and Experimental Engineers

There will be a Rummage Sale in the Workshop, 20, Nassau Street, W.1, on Saturday, January 27th next, at 2.30 p.m., when a large collection of hand tools will be offered for sale. Members are requested not to bring up further lots on this occasion.

The next Meeting of the Society will be held at 56, Old Bailey, London, E.C.4, on Saturday, February 3rd, 1940, at 2.30 p.m., and will be a Competition and Stationary Engine meeting.

Visitors' Tickets and full particulars of the Society may be obtained on application to the Secretary, H. V. STEELE, 14, Ross Road, S.E.25.

The Kent Model Engineering Society

The next meeting of the Society will be held on Friday, January 19th, at Sportsbank Hall, Sportsbank Street, Catford, S.E.6, at 8 p.m. Messrs. Vanner and Biffin will give a joint talk on "Boats."

The following meeting for January 26th will be a lecture by Mr. Bastable on "Petrol Engines."

Full particulars of the Society can be obtained on application to the Hon. Secretary, W. R. COOK, 103, Engleheart Road, S.E.6.

Mancunian Model Engineering Society

At our next meeting, on January 19th, Mr. J. Wood will give us a demonstration of making patterns for loco. cylinders.

Meetings held each Friday, at 8 p.m., at Old Garrett Hotel, Princess Street, Manchester.

Hon. Secretary and Treasurer, H. STUBBS, 23, Ashdene Road, Heaton Mersey, Manchester.

Leicester Society of Model Engineers

The annual general meeting will be held on Sunday, January 21st, at 15, Westcotes Drive, off Narborough Road, at 10 a.m., and members are asked to make a special effort to attend.

Until further notice, meetings will be held once a month at the above address, the dates being announced in good time in THE MODEL ENGINEER.

Joint Hon. Secretary, E. DALLASTON, 25, Bainbridge Road, Braunstone Estate, Leicester.

Norwich and District Society of Model Engineers

There was a good attendance of members at the usual Monthly General Meeting of the Society, held on Thursday, January 4th.

Mr. R. S. E. Hill commenced his talk on "Flash Steam," and described his first engine and boiler, which were fitted in a torpedo boat hull. After experimenting with this, the engine, which is a 2-cylinder single-acting type of $\frac{3}{4}''$ bore and $\frac{5}{8}''$ stroke, was re-designed, and a boiler consisting of 30′ of steel tube was connected to it. With a new single-step hull, a good speed was obtained.

Later, Mr. Hill said, he again re-designed and lightened the engine, and fitted a 26′ steel tube double-coil boiler, fired by twin blowlamps. This plant, in a re-designed hull (the *Erin*), accomplished a speed of 46 m.p.h., about six years ago, which was a world record. Mr. Hill exhibited the hull and plant of *Erin* to illustrate his lecture.

During the discussion which followed, Mr. Hill answered many queries raised by members. On the motion of Mr. Wyatt, Mr. Hill was accorded a hearty vote of thanks.

The next General Meeting will be held on Thursday, January 18th, when Mr. Cooper will lecture on "Model Petrol Engines."

Secretary, F. W. LOVICK, 24, Wymer Street. Norwich.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. Unless remuneration is specially asked for, it will be assumed that the contribution is offered in the general interest. All MSS. should be accompanied by a stamped envelope addressed for return in the event of rejection.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

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All correspondence relating to advertisements to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer." 60, Kingsway, W.C.2